

UGANDA PROTECTORATE

Annual Report

OF THE

DEPARTMENT OF AGRICULTURE

FOR

THE YEAR ENDED 31st MARCH, 1915.

Published by Command of His Excellency the Governor.



KAMPALA :

PRINTED BY THE UGANDA PRINTING AND PUBLISHING COMPANY, LTD.,
1915.

UGANDA PROTECTORATE

DEPARTMENT OF AGRICULTURE

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Veterinary Office and Laboratory, Kampala, P.O. Box No. 63. Telephone No. 14.

Entomological Office and Laboratory, Kampala, P.O. Box No. 5. Telephone
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Botanical Office and Laboratory, Kampala, P. O. Box No. 5. Telephone
No. 26.

Experimental Plantations :— (1) Kampala, (2) Kakumiro, Mubendi.
(3) Kadunguru, Bugondo.

ANNUAL REPORT, 1914-15

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Staff List

Director of Agriculture :

S. SIMPSON, B.Sc., (EDIN.) M.R.A.S.E., N.D.A

District Agricultural Officers :

TYRRELL BRUCE

A. R. MORGAN

L. HEWETT

R. G. HARPER

T. D. MAITLAND

Assistant District Agricultural Officer : J. D. SNOWDEN

Stock Farm Manager : J. S. HARMSWORTH

Ploughing Instructor : G. W. MCNEIL

Biological Division

Entomologist : C. C. GOWDEY, B. Sc., F. E. S., F. Z. S.

Botanist : WM. SMALL, M.A., B.Sc.

Veterinary Division

Chief Veterinary Officer : E. HUTCHINS, M.R.C.V.S.,

Veterinary Officers :

U. F. RICHARDSON, B.S.C., M.R.C.V.S. R. L. HART, M.R.C.V.S.

W. F. POULTON, M.R.C.V.S.

A. N. FOSTER, F.R.C.V.S.

Stock Inspectors :

F. A. POESTKOKE

H. L. LEMON

H. A. STRAUSS

Indian Veterinary Assistants :

H. RAHMATULLAH

FAKHAR-UD-DIN

FAZAL-UD-DIN AHMADI

Clerical Staff

Clerks :

A. S. WIDGERY

J. A. M. D'SA

J. X. D'MELLO

A. C. FERNANDES.

ANNUAL REPORT
OF
THE DEPARTMENT OF AGRICULTURE
UGANDA PROTECTORATE

For the Year ended 31st March, 1915.

STAFF

I proceeded on leave on the 23rd March, returning on the 20th September, Mr. Bruce acting in my absence.

Mr. Morgan returned from leave on the 8th June.

Mr. Harper went on leave on the 23rd March and returned on the 11th November.

Mr. Gowdey went on leave on the 10th August, his duties being undertaken by Mr. Small.

Mr. Hutchins left on leave on the 13th July and returned on the 2nd January, Mr. Richardson acting for him during that period.

Messrs Bruce, Poulton, Hart, Harmsworth, and Veterinary Assistant Fakhar-ud-Din are on local military duties.

General

The one outstanding feature of the year was the outbreak of the European War, and its effects were soon very evident in all branches of agricultural work and development throughout the country.

The weather conditions have been favourable during the year.

Cotton

Cotton still maintains its lead as the most important agricultural and economic product of the Protectorate, and the Eastern Province easily upholds its reputation as the largest and best producing area. Last season's crop was a record one, approximating to 45,000 bales of 400 lbs. each, and it was responsible for most of the exports from November, 1913, to February, 1915. The value of the cotton, at ports of shipment, exported during the year was £351,146, in spite of the fact that the figures for the last three months of the year shewed a decrease of £94,634 compared with the previous year. For over six months of the year cotton was practically unsaleable, and the growers were left for months with the crop on their hands and wholly unable to provide adequate storage accommodation. Large areas were neglected and uprooted, and in some cases the cotton was burnt and otherwise destroyed, as the producers gave up all hope of being able to sell the crop.

Cotton Seed Distribution

Cotton seed is distributed free of charge in bags of 56 lbs. each, and 13,558 bags—or 340 tons—were given out for sowing purposes. The details are interesting.

BUGANDA PROVINCE: 3413 bags, which includes Mengo 2326 (Kyadondo 303, Kyagwe 454, Bulemezi 906, Mawokota 248, Singo 40, Butambala 59, Gomba 51, Busuju 5, Buruli 200, and Bugerere 60), Entebbe 289 (Busiro 208, Buvuma 26, and Sesse 55), Masaka 448, Mubendi 350.

EASTERN PROVINCE: 9,691 bags, which includes Busoga 2,750 (Budiope 1,055, Kigulu 538, Bulamogi 545, Luuka 310, Busia 110, Menya's 75, Luba's 10, Bunyuli 5, Jinja 70, Bukeli 32), Bukedi 1,800 (Pallisa 450, Budama 300, Bunyuli 300, Bugweri 315, S. E. Bugishu 50, Mbale 200, Various 35), Teso 4,061, (Kumi 1,414, Bukidea 480, Soroti 850, Usuku 600, Serere 717), Lango 980.

NORTHERN PROVINCE: 374 bags, which includes Bunyoro 270, Gulu 100, Kitgum 2, West Nile 2.

WESTERN PROVINCE: 80 bags, which includes Toro 50, and Ankole 30.

It is more than likely that all the seed distributed is not utilised, but considerably more than 100,000 acres are under cotton in the Protectorate, and three-fourths of this acreage is in the Eastern Province, where there is a large population which has taken very kindly to cotton production.

Present Season's Sowing

Arrangements for seed distribution are now complete, but, owing to the dislocation of the industry, it is not possible to obtain the seed required from the segregated area (Serere County, Teso District), so the deficiency is being made up from the Jinja ginneries. Much less seed will be distributed, and the planting is expected to be later than usual.

More cotton will be grown in the neighbourhood of the up-country ginneries, but the extraordinary demands for food crops and porters will cause a decrease of cotton production, especially in the Buganda Province.

The Sale of the Crop

Under ordinary conditions the cotton markets are in full swing during November, as the crop is then ripening fast, and two months of dry weather can be relied upon for the transport of the cotton. Porters are plentiful also during that period.

It was not until the 1st February that cotton buying started in a small way, which meant that three months had been lost, and a very anxious time it proved to be for all those interested, and consisted merely of waiting for signs that attempts to purchase the crop were to be made.

The position was aggravated owing to the fact that some firms, usually large buyers of cotton, were out of the market. Even under ordinary circumstances it is with the greatest difficulty that the crop is moved.

The rains come on in March, which not only make transport difficult but spoil the cotton if not properly stored, whilst at that time the natives desire to prepare land for food crops.

Approximately only 6,200 tons, or one-fourth of the estimated crop, had been sold to the end of March, and it is very doubtful if much more than two-thirds of the estimate will be reached.

In some places much of the cotton was not picked, whilst in others cotton in full bearing was uprooted and allowed to rot.

There is every reason to believe that the delays in selling the cotton have affected not only the quantity to be marketed but its quality also, and with the rains coming on before the crop began to move regularly, serious damage is done to the staple before it is finally delivered at a ginnery.

The system of cotton markets in the Eastern Province has worked well, and should be extended to the Northern and Buganda Provinces so that the cotton is brought to central points for sale, thus eliminating the wandering buyers.

Cotton Prices

Prices were low and this induced more firms to take an interest in the crop, as many as thirty being represented, the majority acting as middlemen only. They, however, provided a market for the produce, which is what the grower needs, and it is more than likely that some of them

will become permanently interested in cotton by putting up ginneries.

Handling of the Cotton

The handling of the crop still leaves very much to be desired. Large piles of cotton are left for days together with absolutely no protection from the weather, the result being that cotton, which was clean white and when brought in by the growers, is sent to the ginneries stained and mixed with all manner of trash.

Proper facilities for storing cotton are badly needed in all parts of the Protectorate.

Quality of the Cotton

The quality of the cotton this season is good, and the bulk was brought in clean. The ginning percentage in the Teso District from roller gins is 32%. In October the first pickings from the Kadunguru Plantation, Bugondo, were sent to Messrs. Wolstenholme & Holland, Liverpool, for valuation and report which was as follows :—

SAMPLE A. (ALLEN)

Value 5.80d. Roller, not very well ginned, staple $1\frac{3}{16}$," contained proportion of short fibres, not very strong.

SAMPLE B. (SUNFLOWER)

Value 5.75d. Roller, bright good colour, staple $1\frac{1}{8}$ " to $1\frac{3}{16}$ ", strong, much more readily saleable than A. Middling American spot same date 4.71d.

The ginning percentage of A was 31.59%, and of B 32.62%.

Five samples of cotton grown the previous season at Kadunguru, Bugondo, were sent to the Imperial Institute and the report is given in Appendix No. 5.

Spinning Results

As the spinner is the deciding factor in the price paid for Uganda cotton, visits were made to some Lancashire mills when on leave. On opening bales of Uganda cotton it was gratifying to note the good appearance of the lint, being clean and of good colour, shewing that the ginners are taking more care in the ginning and grading of the cotton. The only fault was the rather high percentage of waste due to immature fibre.

In November, 1914, a bale of this season's cotton, made up of samples A. and B. reported upon in the previous paragraph, was sent to John W. McConnel, Esq., of Manchester, who kindly carried out spinning tests. His report is as follows :—

“With regard to the two sample lots which you were kind enough to send me, I have had tests made in two separate Mills, and the reports are as follows :—

1. A comparison was made with a mixing mainly of Brown Egyptian, which I should suppose would ordinarily cost $\frac{1}{4}$ d per lb. less than Fully Good Fair, or perhaps be a little cheaper still.

The waste was about normal ; sample “A” being considerably more wasty than “B”. The yarn report is as follows :—

“A” :—Rather rough and neppy.

“B” :—Very clean and level

The strength, however, taking the ordinary mixing at 100, would be expressed by 119 for “A”, and 103 for “B.”

2. In the other Mill the comparison was made with Extra Stapled American, for which ordinarily about 2d. per lb over the quotation for Middling, Current Month, is paid.

In this case the waste is reported to be distinctly on the heavy side, with “B” more wasty than “A”. The extra waste of “B” was principally made at the Comber, which would indicate that the fault lay in an extra proportion of short fibres rather than in heavy dirt.

As regards strength, again taking the usual mixing as 100, sample “A” would be expressed by 107, and “B” by 91.

The yarn report is that neither sample is equal to the ordinary quality. “A” is very neppy and “B” being distinctly cleaner than “A”. The colour of both was, of course, quite different from that of the usual mixing.”

It will be noticed that the mixings were made with high class cottons.

Exports of Cotton Seed

Over 9,000 tons of cotton seed, value £ 18,172, were exported during the year but, owing to the increased freights, thousands of tons are being allowed to rot this season. Some firms are expressing the oil and selling the residue for fuel and manure. Planters generally would be well advised to utilise this residue on their plantations, as it is the cheapest and best form of manure available.

The Future

The extension of the cotton industry will proceed as fast as greater facilities for water transport are provided on Lake Kioga, and wheeled

transport put upon the roads, and cotton ginneries worked only in the producing areas. The hundreds of thousands of porters now needed to carry the crop will then devote their energies to the production of cotton and other crops.

Legislation Affecting Cotton

The only alterations brought into operation during the year have been the levying of a fee of Rs. 150 for each licence to purchase raw cotton, and the issue of permits free of charge. Twenty-nine Cotton Licences were sold against 259 issued last year when given out free of charge.

These licence-holders obtain permits free of charge from the District Commissioners in those districts they desire their buyers to operate, and the system works well to the satisfaction of all parties.

Some licence-holders desire to obtain an unlimited supply of permits, but this is discouraged. One firm after obtaining 200 permits for one district asked for more. This will not happen when the market system is introduced into the Buganda Province.

Cotton Markets

The cotton markets of the Eastern Province have now become a permanent feature of the industry, and although up to the present the numbers are large, every effort is made to limit the portorage necessary in moving the crop. As the growers get accustomed to marketing their produce at ginneries and carrying the crop long distances the number of markets will be reduced, so that up-country ginneries will be able to handle a large quantity of the local grown cotton.

Cotton Ginneries

Although there are twenty power ginneries working in the Protectorate, many of these are situated in places which necessitate the transport of seed cotton long distances. There is not a single ginnery in the Bukedi District, which produces 1,000 tons of seed cotton annually, although inquiries have been made regarding the placing of one near the Malawa River on the Mbale-Mjanji Road, whilst another firm is considering the neighbourhood of Pallisa or Gogonyo. Kumi, or the Kumi-Lake Salisbury Road, would also be a good centre for operations, and would tap the largest producing centre of the Teso District. Lango District, with a production of 1,500 tons, does not possess a single ginnery. In Kampala there are six ginneries, although there is little production in the vicinity. If one were removed north of Bombo it would largely draw the cotton from Bulemezi County, which produces cotton of the highest class in fair quantities.

European Plantations

The planting industry has not made great extensions during the year, but steady development work has been carried on, and the position may be regarded as sounder, both agriculturally and economically, than in previous years. Planters Associations are being formed in various parts of the country, and it is probable that some method of affiliation and working with the original Uganda Planters Association will be brought into operation.

Coffee

The crop maintains its position as the principal one on European plantations. The agricultural returns shew that 3,825 acres of *Coffea arabica* under two years old, and 5,726 acres over two years old have been planted, whilst Coffee interplanted with Para Rubber total 1,114 acres under two years, and 3,721 acres over two years. 367 acres of *Coffea robusta* have been planted. Some thousands of acres are estimated to be under cultivation by natives, whilst the various Missions are responsible for a few hundred acres.

The exports for the year are valued at £41,000.

The weather conditions have been favourable for coffee, but estates gave a low average yield, due primarily to the epidemic of coffee leaf disease in July, August, and September, 1913. This killed off a number of plants, and weakened many others to such an extent that their primaries died completely away. The yield was thus very low.

Increased attention should be given to the cultivation, planting out, pruning, and manuring of coffee, whilst the opening of a coffee curing factory will cause more interest to be taken in its preparation for market.

Coffee Leaf Disease

The disease has been much less in evidence throughout the year, and attention is directed to the chart shewing fluctuations of the disease in Kampala in comparison with the rainfall and humidity, and also to the Botanist's report attached.

Cocoa

This crop is now being largely planted and, although only 16 acres are over five years old, 1,852 acres are under five, whilst 1,427 acres have been prepared for cocoa. Sample shipments have been well reported upon and the crop when planted under suitable conditions encourages planters to extend steadily their cocoa area.

Rubber

All the rubbers are neglected with the exception of Para, and, although the area ready for tapping is comparatively small, the results obtained give every encouragement to persevere, as it is an excellent standby and costs comparatively little to bring into bearing when coffee is grown as a catch-crop.

Kampala Plantation

The principal crops grown are coffee, cocoa, and rubber.

A report is attached describing the work of the year, which shews the nature of the experiments carried out.

It will be seen that numerous additions have been made of both economic and decorative plants, and this Plantation distributes annually many thousands of plants and seeds of various kinds. The labour supply has been short during the year.

Kakumiro Plantation

This small Plantation is situated about 120 miles from Kampala, near Mubendi, and a report is attached which gives some idea of the nature of the work done.

Coffee and Para Rubber are the chief crops, although subsidiary ones are cultivated on a small scale.

As a distributing centre for agricultural purposes the Plantation has proved very useful.

In connection with this Plantation an experimental garden has been started 5 miles from Fort Portal on the Mubendi Road, with the idea of cultivating such crops likely to prove successful in Toro.

Kadunguru Plantation

This is situated 8 miles from Bugondo in the Teso District, and although primarily a cotton selection station where most of the work on cotton improvement is carried on, other crops are grown which are suited to the prevailing conditions.

A full report on the year's work is attached.

Tea

The small acreage under this crop shews little tendency to increase, although an ample supply of local grown seed is available.

Two samples of tea grown and prepared on the Kampala Plantation

were forwarded to the Imperial Institute in June, and the report is included in the Appendices.

Wheat

Increased attention has been given to wheat, in Toro particularly, where 500 acres are under cultivation.

During the year a water power stone grinding mill has been erected, whilst a small company has been formed to erect water driven milling machinery so that the local crop can be adequately dealt with. Thus the hand machinery lent to the Church Missionary Society for the handling of the wheat in Fort Portal can be transferred to Mbale, as wheat has been successfully introduced amongst the foot-hills of Mount Elgon, which up to the present could not be utilised.

An experimental parcel of wheat was sent from Mbale to Nairobi, but the total returns were completely swallowed up by transport charges.

Tobacco

Very little interest is taken in tobacco growing on plantations generally, although a few planters grow and sun cure a small quantity for local consumption.

Rice

The natives, particularly in Bukedi, are producing more rice than formerly and, as there is always a good demand, hopes are entertained that efforts will be made to meet the entire wants of the community.

The cleaning of the grain by hand gives trouble, but the difficulties have been easily overcome in other places without the introduction of special machinery.

Sugar Cane

A little sugar cane is grown on two estates, and Jaggree, or unrefined sugar, is manufactured chiefly for local consumption.

Natives generally grow very small patches, but the area under this crop should be much larger, as conditions are favourable and the local demands are increasing rapidly.

Chillies

The exports are decreasing, but, with prices having risen considerably, probably natives will be encouraged to take more interest in this product.

Oil Seeds

Ground nuts and Sim-Sim are the principal oil seeds grown for export, and both should be encouraged, as they are useful adjuncts for food supply in case of a shortage. Natives are also familiar with their cultivation, and the production should be very much greater than at present.

Native Food Crops

All the reports go to shew that this year the food supply is ample, and every effort is being made to meet the extraordinary demands of the present situation.

Labour

Up to the outbreak of war the supply of labour could be considered satisfactory, but later on there was a big shortage in some districts. With extension work on estates being curtailed the position improved somewhat, but it is essential to lessen the quantity of head transport necessary before the position can be regarded as satisfactory.

Many estate owners are increasing their numbers of transport oxen to cultivate by implements and for the transport of produce, but up to the present this question has not been tackled in earnest.

Ploughing Schools

The introduction of ploughing amongst natives has made considerable progress in the Eastern Province, where cattle are abundant, and where the soil and configuration of the land are well suited for ploughing.

Some firms are now stocking ploughs and spare parts, but there is considerable difficulty with repairs.

These Schools are migratory in character and the chiefs send in oxen and men to be trained.

Native Agricultural Instructors

A staff of eighty natives is employed in all parts of the Protectorate to give advice and assistance to cultivators, and there is every reason to believe that their influence is of far reaching and permanent effect. They prove particularly useful in the introduction of new crops.

Live Stock

Hundreds of thousands of cattle, sheep, and goats are owned by the native, and Ankole and Teso are the wealthiest districts in this respect. Little attention is given to live stock generally by Europeans.

For some time past it has been hoped to start a Live Stock Farm at Kumi to help in the improvement of the country's livestock, but up to the present it has not been possible to obtain the necessary funds.

Cattle Diseases

From the Chief Veterinary Officer's report it will be seen that rinderpest is still prevalent in the Eastern Province, and also is now present in the Bugerere and Kiagwe Counties of Mengo District.

The year was a bad one for cattle in the neighbourhood of Kampala owing to an outbreak of trypanosomiasis, and a report by Mr. Richardson is attached.

Veterinary

One extra Stock Inspector was engaged during the year, and one Indian Veterinary Assistant. Mr. Foster was appointed a Veterinary Officer but was unable to come out, and the staff is still short handed.

A full report of the work done by the Veterinary Division is enclosed.

Botanical

The Government Botanist has been fully employed on various crop diseases, and the work done quite justifies the appointment.

The nature of the investigations carried on is of great importance to the planting industry, and his report will repay careful study.

Entomological

There is nothing new to report on insect attacks during the year, and all pests have been kept well under control.

A spasmodic swarm of locusts visited Bunyoro but did little damage.

Museum

The Kampala Museum is now under the control of this Department, and extra show-cases have been added during the year. Various economic products are being prepared for exhibition purposes, as well as examples of the commoner insect and fungoid pests, which are expected to be of some educational value.

Kew and Imperial Institute

Consignments of various descriptions have been forwarded to both the above institutions, and two reports by the Imperial Institute will be found in the Appendices.

Kampala Swamp

This swamp is now being cleared and planted up and, although the labour supply has been insufficient for the work allocated to this Department, a satisfactory start has been made.

Importation of Plants and Seeds

All plants and seeds imported must pass through this Department for fumigation purposes, and importers to save delay should arrange for this to be done.

Imports of cotton and coffee seeds and plants are not allowed without special permission, whilst imports from Ceylon are prohibited.

Agricultural Statistics

These are given in the Appendices and, whilst those for native agriculture can only be assumed to be approximate, those for European plantations give a clear idea of the acreage under various crops.

Thanks are due to all those who have helped to make these statistics materialise.

Conclusion

The past three years have been anxious and strenuous ones to all those interested in agricultural development, but the various problems have been faced by the commercial and planting community with a confidence and energy deserving the fullest praise.

The Department has been much understaffed in various branches, and I have to thank all the members of the staff for the work done during the year.

S. SIMPSON,

Director of Agriculture,

Uganda Protectorate.

Government Plantation, Kampala

Report for the Year 1914-1915

Meteorological Records

The weather conditions during the period under review were far more favourable than was the case during the period covered by the previous Annual Report, and, although the total number of days is only three over that for the previous year, the total rainfall is 14.66 inches greater than the previous record. The distribution of the rain was more equal, and only during the months of December and January, 1914-1915, was anything like drought approached.

The following are comparative records for the last five years :—

Months.	1910-11		1911-12		1912-13		1913-14		1914-15	
	No. of days.	Inches.	No. of days.	Inches.	No. of days.	Inches.	No. of days.	Inches.	No. of days.	Inches.
April	18	8.75	15	5.84	27	5.73	24	10.16	18	6.60
May	16	7.72	18	4.85	24	4.54	20	5.06	15	3.85
June	7	2.49	9	3.82	20	3.00	13	2.17	16	5.14
July	11	3.25	3	.20	15	2.65	11	2.61	12	5.43
August	7	7.71	21	5.60	18	10.39	7	.83	14	5.50
September	15	8.28	19	2.84	13	1.96	8	3.50	18	5.12
October	11	3.00	14	.79	21	6.21	20	1.78	19	5.43
November	15	8.25	24	8.60	23	3.07	20	3.80	26	8.00
December	15	4.57	10	.57	21	5.13	12	2.95	6	.55
January	8	1.13	11	3.12	8	2.37	9	3.63	5	.69
February	4	.77	12	2.57	15	3.96	9	1.63	12	4.90
March	16	6.65	26	8.39	15	7.68	20	3.81	15	4.01
Totals.	143	60.57	182	47.19	220	56.69	173	41.93	176	56.82

Monthly Average Temperature

Year 1914-15

Month	At 7. a. m.		At 2. p. m.		Max. Temp.	Min. Temp.	Highest Maximum Recorded.	Lowest Minimum Recorded.
	Dry Bulb.	Wet Bulb.	Dry Bulb.	Wet Bulb.				
April	69.3	67.87	81.83	76.9	84.1	64.2	89	61
May	68.58	67.42	79.84	76.29	82.8	64.29	87	62
June	67.06	65.7	78.56	75.23	82.73	63.03	86	60
July	64.03	62.71	75.93	71.35	79.39	61.00	84	58
August	64.71	63.35	78.77	60.25	71.38	70.87	82	64
September	64.56	63.63	80.7	61.46	77.16	73.1	84	66
October	66.03	64.48	78.55	74.06	81.71	62.71	85	60
November	65.7	64.5	80.36	62.36	76.6	73.83	82	68
December	66.45	64.7	79.03	74.22	81.55	63.29	84	61
January	68.29	65.09	80.99	74.51	81.71	64.97	87	61
February	68.89	67.6	79.92	76.57	82.00	66.21	85	62
March	66.4	67.39	79.13	76.4	81.55	65.84	86	63

Labour

Although the labour supply was better throughout the year than previously, it was so irregular that it was impossible to take full advantage of it.

Nursery

Numerous additions of both Economic and Decorative plants were made to the nursery stock during the year, and the distribution of plants was well maintained.

The following are the records of Plants and Seeds distributed during the last four quarters :—

	Economic Plants	Decorative Plants	Coffee for Seed	Cacao Seed	Tea Seed	Various Seed	Seeds in Packets
			lbs.			lbs.	
1st qr.	1014	370	85	7625	—	—	2
2nd qr.	—	237	555	7950	625	—	5
3rd qr.	1009	293	30	6037	350	143½	6
4th qr.	—	570	—	6766	2900	30	2
Totals.	2093	1470	670	28378	3250	173½	15

Coffea Arabica

The present year has seen a decided improvement as far as the Leaf Disease and Die-back are concerned.

No doubt the climatic conditions of the present year have been as favourable to the coffee trees as the climatic conditions of the previous year were unfavourable, for the advent of the leaf disease culminated in a spell of drought seriously crippling the trees ; whereas the greater rainfall during the present year, although giving the disease a fresh impetus—for the disease has been present to a considerable extent—also created vigorous growth in the trees which were thus enabled to keep pace with it. How far and important is the part played by the weather conditions in the life of the disease may be seen at a glance from the chart overleaf.

It will be noticed that a high rainfall preceded the gradual rise of disease, causing defoliation ; then extreme drought causing wholesale die-back and numerous deaths amongst the trees. This spell of drought was phenomenal and resulted in a serious shortage of food among the natives,

and in parts a serious lack of water. This drought subsided in September of that year by a rainfall in one day of 1.68 inches. This stimulated the trees into new growth, with a sufficient subsequent rainfall to maintain it. This new growth enjoyed meantime partial immunity from the disease, but then again a gradual rise in the percentage of disease present takes place with the increasing rainfall. The rapid falls in the disease are due to the trees having supplemented their leaves by a new leaf system. This in two cases, i.e., from September, 1913, and November, 1914, was enhanced by drought followed by a good rainfall, and in the other case, viz., September, 1914, by a natural process of the renewal of the leaf system.

Comparing then the climatic conditions of last year and the leaf disease and die-back with the climatic conditions of the present year and the improved condition of affairs as regards leaf disease and die-back, it would appear that what we have most to fear are the spells of drought which deprive the trees of the stimulus necessary to enable them to resist the disease, for, as was pointed out in a previous report, the high percentage of die-back among the trees was due in large measure to the phenomenally dry conditions then prevailing. This contention was again borne out by the considerable die-back present during the short drought of December and January, 1914-15.

That the effects of the leaf disease and die-back have considerably reduced the yields of the trees will be seen from the following records :—

Coffea Arabica

Nyasaland Variety 5½ years 9' x 10'

No. of Plot.	Total No. of Trees.	No. of Good Trees.	No. of indifferent Trees.	No. of Deaths.	Total Yield of Berries.	Average Yield of Berries.	Remarks.
1. A.	249	87	115	47	49 lbs.	3.88 ozs.	unmanured.

These 249 trees make up 4 rows of the original coffee on the Plantation. This plot was so much affected by the leaf disease and die-back that during the latter part of 1913 it was uprooted, with the exception of these 4 rows which were left as a test. Assuming that a tree 5 years old should produce at least 1 lb. of parchment coffee it will be seen that the bearing capacity of these trees has been reduced by three-fourths if not considerably more.

Nor are the facts any more encouraging in the next series of plots, with perhaps the possible exception of No. 1, which were also considerably

affected by leaf disease and die-back. These plots show a high percentage of indifferent trees. It is interesting, however, to notice that the only plot which is anyway near the normal is the manured one with a greater number of normal trees and consequently a higher average yield. These plots were on a par, previous to the manurial test.

Nyasaland Variety 4½ years 6' x 8'

No. of Plot.	Total No. of Trees.	No. of Good Trees.	No. of indifferent Trees.	No. of Deaths.	Total Yield of Berries.	Average Yield of Berries.	Remarks.
1.	767	590	126	51	lbs. 287½	ozs. 5.3	Manured with Farmyard manure and Kainit and pruned in 1913.
2.	1328	653	533	42	108	1.45	unmanured.
3.	1439	589	786	64	138½	1.61	unmanured.

The only coffee which is in a normal state of health at present is the series of the younger plots. These plots, although they were diseased, were never seriously affected by it, as during the advent of the disease they had not yet reached a reproductive stage and were therefore not handicapped by crops. The die-back is present only in the older plots where there was an excess of leaf disease and excessive cropping. The yields from the younger plots are as follows :—

Nyasaland Variety 3 years 8' x 8'

No. of Plot.	Total No. of Trees.	No. of Good Trees.	No. of indifferent Trees.	No. of Deaths.	Total Yield of Berries.	Average Yield of Berries.	Remarks.
4.	737	737	Nil	Nil	lbs. 251½	ozs. 5.44	Manured with Cotton seed.
5.	312	312	Nil	Nil	100	5	Unmanured

Nyasaland Variety 3 years 6' x 8' Diagonally

6.	1588	1588	Nil	Nil	611½	6.16	Part of this plot was manured with Basic Slag. 1913.
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Chlorosis

Several instances of this occurred in the plot of young coffee, and generally existed in patches, pointing apparently to a weakness of the soil. It is of fairly common occurrence throughout the country and is attributed by the natives to "lunyu," or salt in the soil, but how far this theory is correct it is impossible at present to say. The trees present a yellow sickly appearance, and this is more pronounced during dry conditions. These particular trees were manured with liquid cow manure, and in each case recovered their normal condition in a few weeks' time.

Cacao

The following records are sufficient to show the satisfactory progress made by the Cacao crop during the year.

It will be observed that the prolificacy of some trees and the poorer fruiting qualities of others are again in striking contrast, and that the average increases under the various types for the present period are high as compared with those for the previous.

These trees, it may be pointed out, are not picked trees, but represent good, bad, and indifferent ones, and are not confined to any slope or level but dispersed throughout the Plantation.

Averages for 9 months.

THEOBROMA CACAO FORASTERO.						THEOBROMA CACAO CALABACILLO					
Red Variety.			Yellow Variety.			Red Variety			Yellow Variety.		
No. of Tree.	No. of Pods.	Prev-ious Yield.	No. of Tree.	No. of Pods.	Prev-ious Yield.	No. of Tree.	No. of Pods.	Prev-ious Yield.	No. of Tree.	No. of Pods.	Prev-ious Yield.
6	47	27	1	45	12	2	23	34	46	67	12
10	9	8	3	63	28	4	19	21	57	15	2
16	4	8	9	10	19	5	19	32	59	34	30
17	28	19	11	12	8	8	0	2	69	53	1
20	0	13	12	5	4	15	22	18	77	0	1
21	11	11	13	11	8	87	49	43	78	0	7
22	51	11	14	0	8						
24	7	9	18	12	2						
26	3	6	19	44	4						
27	9	4	23	40	3						
29	40	11	25	17	9						
31	28	9	28	60	4						
32	55	2	30	29	9						
33	8	3	39	3	1						
34	10	7	42	0	2						
35	21	8	43	2	2						
36	12	11	45	71	8						
37	3	4	47	29	4						
38	64	7	49	2	6						
40	27	1	50	7	4						
41	60	11	51	18	1						
44	4	2	52	18	11						
48	44	7	53	13	14						
55	28	1	54	12	3						
56	3	4	58	1	6						
60	5	4	61	14	4						
62	1	2	67	62	11						
65	3	4	68	2	10						
71	5	5	70	12	6						
72	74	8	76	0	16						
74	20	15	79	15	3						
75	21	24	82	92	46						
80	0	12									
81	10	14									
34	715	292	32	725	282	6	132	150	6	169	53
Previous Average.		8.6			8.8			25			8.8
Present Average.	21			22.65			22			28	

The present averages in the above table represent the yields for the same number of months as the previous averages, viz., 9 months.

The following records represent the yields and averages for the last 12 months, and are also of interest on that account.

Averages for 12 months

THEOBROMA CACAO FORASTERO.						THEOBROMA CACAO CALABACILLO					
Red Variety.			Yellow Variety.			Red Variety			Yellow Variety.		
No. of Tree.	No. of Pods.	Prev. ious Yield.	No. of Tree.	No. of Pods.	Prev. ious Yield.	No. of Tree.	No. of Pods.	Prev. ious Yield.	No. of Tree.	No. of Pods.	Prev. ious Yield.
34	789		32	814		6	150		6	183	
1	23.2		1	25.44		1	25		1	30.5	

The following monthly gatherings of pods from 78 trees for the last 21 months point to a more or less continual cropping—with slight flushes—rather than to a decided cropping and resting period.

YEAR.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.
1913-14	—	—	—	128	40	52	75	93	160	117	35	10
1914-15	40	51	130	192	39	99	217	381	370	222	186	25

Model Plots

Four one acre plots of Cacao containing *Forastero* and *Calabacillo* types, and three one acre plots of Coffee containing *Coffea robusta* and Costa Rica *C. arabica*, var. were laid out during the year and with the exception of the Costa Rica coffee, are well established and promising well.

Covercrops, Green Manures, and Wash Preventive

Several crops were experimented with in this respect, including *Cajanus indicus* "Dhal" and *Crotalaria striata*. These crops were both grown on a slope in the Para plots, and, in addition to serving as cover and wash preventive crops, yielded the following in green mulch:—

Name of crop.	Age when first cut.	First yield of vegetable matter.	Age at second cutting.	Second yield of vegetable matter.	Total yield per acre.	Remarks
"Dhal" <i>Cajanus indicus</i> .	3½ months.	1 ton 8 cwts. 72 lbs.	8½ months.	3 tons 2 cwts. 89 lbs.	4 tons 11 cwts. 49 lbs.	The second cutting was more woody than the first, but nevertheless rotted quickly. Cut to 4" from base
<i>Crotalaria striata</i> .	6 months.	1 ton 18 cwts. 45 lbs. (¼ acre)		=	7 tons 13 cwts. 68 lbs.	The full benefit of this crop is best obtained by digging it in soon after cutting. The bulk of the moisture in the succulent leaves and stalks is thus conserved. This crop died after the first cutting. Cut to 6" from base.

Several other leguminous crops were imported from various parts of the world, including Java, and these were tested together with several indigenous plants. The table attached shews the advantages and disadvantages of each. It will be observed that the disadvantage of most of these crops is the smallness of the seeds, these being difficult to collect, handle, and sow. They are also more easily overcome by the weed crop, but are nevertheless well suited as cover and green crops where the land is clean and the weed crop well under hand. The others having larger seeds facilitate handling, collecting, and sowing, and when germinated produce a larger and stronger seedling, not so easily overcome by adverse conditions. It will be further noticed that some of the species are more susceptible to inoculation by the nitrifying bacteria in the soil than others, as is indicated by the X's, for in some cases the roots were simply a warted mass, whereas in others only slight signs of attack were observable. This is interesting: as well as shewing that as a means to the fixation of free nitrogen some leguminous crops apparently would be of more value than others. These crops were grown on a small patch of land with little or no variation in it, and in which Sweet Potatoes—a crop severe on the nitrates of the soil—had been previously growing.

It can be deduced therefore from these observations that the crops best suited for growing in coffee as covercrops, green crops, and wash preventives are *Vigna sinensis*, *Centrosema Plumirei*, and *Canavalia sp*, their short habit of growth adapting them for this purpose. These two latter have unfortunately been attacked by several diseases, *Uromyces appendiculatus* (Pers.) Link, probably *Sphaerella orotalariae* and another. Notwithstanding this fact they have been used to advantage on the Plantation. The *Crotalaria*s, *Indigoferas*, *Tephrosias*, and *Cajanus indicus* "Dhal", although their height is a drawback as far as the coffee crop is concerned, can be rendered suitable provided they are trimmed from time to time to prevent interfering with the trees, and are excellent during the young stages of the coffee trees.

Name of Plant.	Time in germination. (days)	Nature of Seed.	Style of growth.	Height of Plant.	Extent attacked by Bacteria.	Remarks.
<i>Mucuna gigantea</i> -do- sp. -do- Lyonii Rose Cocus	11 10 10 10	Large " " "	Prostrate & Climbing " " "	— — — —	x xxx x xxx	These crops are not suitable for growing among other plants unless trees, i. e., Para rubber. Their climbing habit prevents them from being of use as a cover and wash crop for coffee.
<i>Canavalia</i> sp.	10	"	Erect	2'-2½'	xx	The short erect habit of this plant is an advantage. It is very easy to sow and grows well.
<i>Vigna Sinensis</i> <i>Centrosema Plumieri.</i>	8 10	Small "	Prostrate. "	— —	xx xxx	These are excellent crops and suitable as cover crops for coffee. The seed is easily collected being the size of a pea. The plant grows well.
<i>Crotalaria incana</i> -do- ferruginea -do- spp. -do- striata -do- sp.	9 11 11 11 11	Very Small " " " "	Erect " " " "	3' 2' 2'-4' 4' 4'	x x x xxx xx	These are good cover crops when once established; although the seeds are small. <i>C. striata</i> and <i>Crotalaria</i> sp. are the best. They are succulent and leafy and grow quicker than the others.
<i>Indigofera hirsuta</i> -do- longerasemosa -do- sufruticosa Tephrosia Hookeriana var.	10 10 7 10	" " " "	" " " "	2'-3' 4' 5' 2'	x xx x xx	<i>Indigofera hirsuta</i> is probably the best of these, but where <i>Crotalaria striata</i> and <i>Crotalaria</i> sp. can be grown it would be advisable to adopt them in place of the Indigoferas. This Tephrosia being short is suited for growing with coffee.
<i>Tephrosia Vogelii</i> <i>Sesbania</i> sp. <i>Cajanus indicus</i>	10 12 10	Small " "	" " "	4'-8' 4'-8' 4'-8'	xxx x x	The first two mentioned are not comparable with the latter. The pea size seed of the <i>Cajanus indicus</i> gives it the advantage and this advantage is maintained in the seedling.
<i>Cassia</i> sp.	10	Very small	"	1'	xxx	This plant is rather weak to be of much use as a cover crop.

Starch and Flour

The following results of the manufacture of Starch and Flour from the roots of Cassava, Ceara Rubber, and Sweet Potatoes are of interest in shewing the amount of starch contained in the roots of these various crops and the amount of edible matter in the shape of flour.

The young fleshy roots of Ceara were chosen as they naturally contain a greater percentage of starch than the older and woodier ones. The starch moreover is more easily extracted.

These products were prepared for exhibition purposes.

Crop.	Weight when fresh.	Loss in Skinning.	Residuc.	Loss in Moisture.	Weight of Product.	Remarks.
Cassava. Manihot utilissima.	30 lbs.	6½ lbs.	5 lbs. 12 ozs.	17 lbs. 12 ozs.	5½ lbs.	Starch.
Ceara. Manihot Glaziovii.	41 lbs.	5 lbs. 11 ozs.	2½ lbs.	32 lbs.	1½ lbs.	
Sweet Potatoes. Ipomaea Batatas.	30 lbs.	2½ lbs.	4½ lbs.	21 lbs.	2 lbs.	
Cassava. Manihot utilissima.	20 lbs.	2½ lbs.		13 lbs. 6½ ozs.	4 lbs. 1½ ozs.	Flour.
Sweet Potatoes. Ipomaea Batatas.	34 lbs.	2½ lbs.		26 lbs. 14 ozs.	4 lbs. 10 ozs.	

Para Rubber

These trees are now nearly five years old, but only one has reached a tappable size, i.e., 21½ inches. The records of the girth measurements shew only a slight proportional increase over those of the previous year, the average girth measurement of the trees at present being 12 inches.

The records are as follows :—

Date when Planted.	1st Measurement. March, 1912.	2nd Measurement. Sept., 1912.	Average Increase during 7 months.	3rd Measurement. Aug., 1913.	Average Increase during 11 months.	4th Measurement. Jan., 1914.	Average Increase during 5 months.	5th Measurement. Aug., 1914.	Average Increase during 7 months.	6th Measurement. Jan., 1915.	Average Increase during 5 months.
	Average Girth.	Average Girth.		Average Girth.		Average Girth.		Average Girth.		Average Girth.	
May, 1910.	3½"	5½"	1½"	7¾"	2¾"	8¾"	1½"	10½"	1¾"	12"	1¾"

Tea

The Tea plots have made satisfactory growth during the year, and the one reserved for seed purposes has yielded some thousands of seeds, the majority of which have been distributed among various localities.

The plot reserved for test purposes as regards yields of leaf had to be pruned into shape, as it had also originally been left for seed purposes.

The yields to date are not of sufficient interest to include in this report as the records of yields have been kept over a short period only.

Hedychium Coronarium

This plant, in which considerable interest has been taken during recent years as a paper-pulp yielding plant, was tested, but the results have been unsatisfactory. The growth in both plots, the one on the swamp and the one on the higher level, has been slow and stunted, and in no way compares with the tall growth of the native *Amomums*.

General

There are other crops and numerous plants which have been introduced and planted, but which are not of sufficient general interest at present to justify inclusion in this Report.

T. D. MAITLAND.

District Agricultural Officer.

Annual Report on Kakumiro Plantation, 1914-15.

Rainfall Records

The rainfall was good up to the end of November, when drier weather set in, January being a very dry month. The rainfall was exceptionally heavy during October and November.

The records for the past two and a half years are given in the following table.

Month.	1912-13	1913-14	1914-15
	Inches of rain.	Inches of rain.	Inches of rain.
April ...	No record	7.16	5.18
May ...	"	2.12	2.86
June ...	"	No record	3.50
July ...	"	1.29	3.07
August ...	"	2.48	4.95
September	"	4.37	6.74
October ...	3.01	6.49	8.16
November	6.06	3.13	8.71
December	1.10	.14	1.11
January ...	1.17	2.05	12
February ...	2.85	.77	1.46
March ...	3.91	6.09	4.38
Total inches	18.10	36.09	50.24

Area

There has been no increase in the total area under cultivation during the past year, but part of the area formerly under annual crops has been planted up with permanent crops.

Coffea arabica var. Nyasaland

The following table gives particulars of the areas and the yields obtained during the past three years. The trees are planted 8' x 8', but the trees planted in 1910 are planted on the triangular system.

Year Planted	Area in acres	Average number of trees per acre			Average yield per acre in pounds			Average yield per tree in pounds.		
		1912-13	1913-14	1914-15	1912-13	1913-14	1914-15	1912-13	1913-14	1914-15.
1904	5.23	525	546	541	1052	1034	233	2	1.89	.43
1906	2.11	578	627	611	1099	483	130	1.89	.77	.21
1907	1.90	487	630	603	761	1274	347	1.56	2.04	.57
1910	1.95	683	774	771	474	1712	638	.69	2.21	.82
1911	2.99	-	635	616	-	107	200	-	.16	.32
1912	1.21	-	623	644	-	123	880	-	.19	1.36
1913	7.97	-	-	654	-	-	99	-	-	.15

It will be seen from the above table that there has been a large decrease in the crop during the past year in the case of all trees which had reached their maximum capacity for bearing either in or before the year 1913-14, namely the trees planted either in or before the year 1910. In some cases the crop has been reduced to only about one-quarter of that of the preceding year, the yield of the trees planted in 1906 being particularly low.

The trees planted in 1911 and 1912 have shown an increase which is due to the trees increasing in size and also in the case of the latter trees, to the picking only commencing in the latter part of 1913-14, so that the figures shown for that year do not represent a full year's picking.

The cause of the reduction in the crop from the older trees is for the most part due to the very bad attack of *Hemileia vastatrix* which was first noticed on the trees here in July, 1913, and has since spread considerably.

The effect of the very dry weather obtaining during the months of December, January, and February, 1913-14, would also tend to shew itself in the reduction of the crop during the year under review.

Hemileia vastatrix has been prevalent throughout the year, especially during the heavy rains in the months of September, October, and November. Spraying with Burgundy Mixture was carried out for some months on some of the younger trees, but no conclusive results were obtained. Experiments have been put in hand with a view to testing the result

of manuring some of the trees.

The number of trees which have been killed by the disease is very small, and it is probable that, having got over the effects of the first attack, the trees may again recover some of their former vigour and cropping abilities during the coming year.

Scale Insects : A large number of the trees planted in 1913 have been attacked on the roots by scale insects of the type known as "Mealy Bug". These insects seem to be more prevalent in the poorer soils containing a large proportion of very fine quartzite stones, and in soils previously impoverished by other crops. They are found on the roots of a large number of other plants in addition to coffee.

Stem Borers : A few trees were attacked by stem boring insects belonging to the family *Bastrychidae*, but up to now they have not spread very far and are easily killed by inserting a thin wire into their burrows.

Shade Trees : A number of *Erythrina velutina* and *E. umbrosa* have been planted, 40' x 40' and 48' x 48' apart, among some of the coffee plots, in order to demonstrate the value, or otherwise, of shade, but it will be some time before the trees obtain dimensions sufficient for that purpose.

Other Coffee Varieties and Species

Coffea arabica var. *Costa Rica*. Half an acre was planted with this variety in August, 1914. The trees are making fairly good growth, but have been attacked by *Hemileia vastatrix*.

Coffea stenophylla. About one hundred plants of this species have been received from Kampala, from seed received from the Gold Coast and planted in a small plot.

Native Coffee. (*Coffea robusta* var.) A large number of plants of this species have been raised and will be planted out as soon as they are large enough.

Rubber

Particulars of the measurements of the rubber trees are given in the table below. The Para and Funtumia Rubbers were much neglected in their earlier years of growth, before the Plantation was taken over by this Department, and the troublesome weed "Lumbugu", a kind of couch grass, was allowed to establish itself amongst the root of the trees, and it has since been impossible to get rid of it without doing serious injury to the trees.

This fact must be taken into consideration when comparing the growth and yields of the trees.

Particulars of Measurements	Para planted 1906 20' x 20'		Funtumia planted 1906 8' x 8'		Ceara planted 1912 15' x 15'	
	1913-14	1914-15	1913-14	1914-15	1913-14	1914-15
Number of trees	367	673	77	77	350	343
Average girth at 3 feet.	17.10 inches	19.47 inches	17 inches	18 inches	12 inches	15.32 inches
Max. "	26 "	28 "	24 "	26 "	21 "	24 "
Min. "	11 "	12 "	9 "	10 "	9 "	10 "
Average increase in girth	1.77 "	2.37 "	—	1 "	—	3.32 "

Para Rubber. Further tapping experiments were carried out on some of the larger trees, particulars of which are given in the appended table.

Group or number of Tree.	Number of Trees.	Av. girth at 3 feet in inches.	Method of Tapping.	No. of times tapped.	Biscuit Rubber in ozs.	Scrap Rubber in ozs.	Total Rubber in ozs.	Av. Rubber per tree in ozs.
A.	26	23	Half-her-ring Bone.	98	264 $\frac{1}{4}$	66	330 $\frac{1}{4}$	12.70
B.	20	20 $\frac{3}{10}$	"	79	137 $\frac{1}{2}$	40 $\frac{1}{2}$	178	8.90
C.	10	20 $\frac{4}{5}$	Basal V	80	63 $\frac{3}{4}$	19	82 $\frac{3}{4}$	8.27
D.	14	20 $\frac{9}{14}$	Two Vs.	80	125 $\frac{3}{4}$	24	149 $\frac{3}{4}$	10.69
No.1.	1	21	Full-her-ring Bone	79	7 $\frac{3}{4}$	3 $\frac{1}{4}$	11	11
" 33	1	21	"	79	8 $\frac{1}{8}$	2 $\frac{1}{4}$	10 $\frac{3}{8}$	10 $\frac{3}{8}$
" 130	1	21	Spiral	67	10 $\frac{3}{4}$	2 $\frac{3}{4}$	13 $\frac{1}{2}$	13 $\frac{1}{2}$
" 133	1	21	"	67	15 $\frac{1}{2}$	2 $\frac{3}{4}$	18 $\frac{1}{4}$	18 $\frac{1}{4}$
" 173	1	22	Basal V.	79	5 $\frac{5}{16}$	2 $\frac{5}{8}$	7 $\frac{15}{16}$	7 $\frac{15}{16}$
" 195	1	21	"	79	12	2 $\frac{7}{8}$	14 $\frac{7}{8}$	14 $\frac{7}{8}$
" 198	1	20	Half-her-ring Bone	79	16	3	19	19
" 208	1	21	"	79	5 $\frac{3}{8}$	2 $\frac{1}{4}$	7 $\frac{5}{8}$	7 $\frac{5}{8}$
" 199	1	20	Basal-cut	79	3 $\frac{15}{16}$	2 $\frac{1}{4}$	6 $\frac{3}{16}$	6 $\frac{3}{16}$

The results obtained were very fair considering the altitude (4,500 feet) and the fact that, owing to my frequent absence on safari, the tapping was largely in the hands of the native headmen.

The trees were tapped on alternate days commencing at the beginning of April in the case of trees in Group A, and May in the case of the other trees, and ending at the end of November, with an interval of three weeks rest at the end of August and the beginning of September.

The trees were tapped to a height of four feet except in the case of the V. and basal-cut methods, and only one-third of the circumference of the trees was tapped except in the case of the two trees on the Spiral system.

Of the different methods tried, that of the two V's, consisting of two V. shaped cuts one foot apart and connected with a vertical cut, the collecting cup being placed at the point of the lowest V, is in the writer's opinion the best method, as giving a good yield with a low percentage of scrap rubber in proportion to biscuit rubber, and also allowing sufficient space for a second series of tapping above the first series, and thus allowing six years to elapse before returning to tap the area first tapped.

The fact that the trees in group A were tapped eighteen times more than the other trees, and their higher average girth, accounts for their higher yield.

The results obtained from the single trees are of little value in demonstrating the merits of any particular method of tapping, but shew that individual trees vary considerably in the amount of rubber they yield.

A large number of seeds were collected from the trees, some of which have been sown in the nurseries and the remainder have been distributed in various parts of the Protectorate.

Ceara Rubber. A number of trees planted in June, 1912, along one of the plantation paths were tapped on the Spiral system during December and January, the object being to obtain as much rubber as possible before removing the trees, which are very irregular in growth with bad tapping stems, to make room for an avenue of *Grevillea robusta*.

The number of the trees tapped was 65, having an average girth of 19 inches at 3 feet. They were tapped 24 times and yielded 110 oz. of dry rubber. The flow of latex being then small the trees were rested and will be tapped again later.

The trees planted in July, 1912, have made good growth, and a large number of them are now ready for tapping.

Cacao

The cacao has not done very well, many of the plants first planted having died off, and although these were replaced, some have again died off. Some of the stronger plants have made fair progress, but with the majority growth has been very slow.

A small additional area has been planted with bananas for shade ready for planting up with cacao, bringing the total area up to one acre. This area should prove sufficient to determine whether the crop is likely to prove successful here or not. In the writer's opinion the climate is too dry between the rains, which, combined with a low temperature when the rains are in progress, due to the altitude, and a soil not over rich in humus, is not conducive to good cacao cultivation.

Silkworm Trees. *Bridelia micrantha* var. *ferruginea*.

The growth of these trees varies considerably, some having made excellent growth whilst others have made hardly any. The largest trees are about five feet high and are branching freely.

The trees make very little growth during dry weather, and do not appear to do so well when cultivated on high ground as when growing in their natural habitat near the swamps.

Green Manure and Catch Crops

Mucuna gigantea, has proved useful as a green manure, but its habit of climbing over the coffee trees is much against its more general use.

Cajanus indicus has proved very useful as a shade for the young cacao, apart from its use as a green manure.

Crotalaria striata, a few seeds of which were sown, did not germinate very well, and most of the resulting plants died.

Tephrosia Vogelii is a very promising green manure plant. The seeds did not germinate very well but the resulting plants have made vigorous growth and a good stock of seed should be obtained from them, from which a good trial of it may be made.

Rose cocus, *Soya*, and *Native Beans* have been grown between the rows of the younger coffee as catch-crops, but the results have not been satisfactory. The crops obtained have for the most part been small, and as there is very little local demand, and the price will not admit of transport elsewhere, the use of some of the green manures mentioned above for mulching or digging in the soil are much to be preferred.

Citrus Fruits

Lemons do exceedingly well here, but there are only a few trees planted at present as unfortunately there is not much demand for them.

Oranges, of which three dozen trees have recently been planted, should do equally well.

Tea

A few tea plants received from Kampala have been planted out, whilst a number of seedlings are being raised in the nurseries, and it is hoped that an acre or two may be planted up with this crop later on.

Useful Trees

A few trees of each of the following species have been planted during the year: *Acacia farnesiana*, *Anona muricata*, *A. squamosa*, *Cedrella Toona*, *Cedrus* sp. *Erythroxylon Coca*, *Gliricidia maculata*, *Eucalyptus* sp. *Grevillea robusta*, *Morus nigra*, *Mammea americana* and *Tamarindus indica*.

J. D. SNOWDEN,

Assistant District Agricultural Officer.

Annual Report on the Government Plantation, Kadunguru, Bugondo

Weather

The following table shews the rainfall month by month for the year ending March 31st, 1915, also comparison with that of the previous years :—

Month	1912-13		1913-14		1914-15	
	No. of days on which rain fell.	Amount of rain in inches.	No. of days on which rain fell.	Amount of rain in inches.	No. of days on which rain fell.	Amount of rain in inches.
April	6	3.75 (from 18th)	16	9.06	11	3.77
May	14	7.12	23	10.24	14	7.50
June	11	4.55	18	7.66	15	5.48
July	11	4.00	6	4.49	13	4.73
August ...	11	7.85	8	2.52	16	5.18
September...	11	3.26	4	0.91	14	7.95
October ...	10	3.17	14	6.11	20	5.85
November...	9	3.31	12	3.99	21	11.70
December ...	2	0.58	4	1.88	3	0.36
January ...	Nil	Nil	4	2.20	Nil	Nil
February ...	7	3.95	5	1.37	Nil	Nil
March... ..	9	4.17	10	3.53	9	6.02
Totals... ..	99	45.71	124	51.96	136	58.54

The outstanding features of the weather of the past year were the abnormally heavy rainfall of the months August to November, and the three months drought which followed.

Heavy rains during the months of August and September are usually accompanied by cold nights, which have a very prejudicial effect on the early cotton crops, at that period in the budding and flowering stage.

Hail-storms occurred towards the end of September and did considerable damage to the cotton crops.

Crop Areas

The following are the areas of crops grown on the Plantation during the past year :—

Crops.	Acres.
Cotton : Sunflower variety	23
do Allen „	37
	60
Maize	4
Buckwheat	2
Sim Sim	5
Ground nuts	4
Wimbe (Millet)	2
Gram (Indian)	$\frac{1}{2}$
Beans	$\frac{1}{2}$
Peas	$\frac{1}{2}$
Tobacco	$\frac{1}{2}$
Sweet Potatoes	10
Total	89

Cotton Seed Selection and Propagation

The work of seed selection was continued on the lines of previous years, although I was absent from the Plantation on leave for nine months of the year.

Allen Cotton

Plots 3, 4, 13, 17, 25, 51, of the previous year's crop were retained for propagation, and the seed from each of these plots was sown in separate fields on the Plantation. No. 17, which was looked upon as the best selection, occupied about 18 acres, or one-half of the area allotted to Allen cotton. Nos. 3, 25 and 5 acres each. Nos. 4, 13, 51, and 3 acres each.

No. 17 was sown early in the season, and suffered so greatly from the storms and low temperatures of August and September, that the crop was a partial failure and a very low yield was obtained.

The 18 acre field was in an exposed place, and the crop had no shelter whatever from the storms, with the above result. The general unhealthiness of the crop shewed itself on the quality of the lint, which was also disappointing, and the good qualities, for which it was selected during the previous two years, were conspicuous by their absence.

No. 25 probably did best of all the plots. This was sown in July in a more sheltered part of the Plantation. The yield was good and the quality of the lint shewed no deterioration on that of previous years.

No. 4 retained its qualities—the seed being almost naked, and the lint very silky and strong although not very long.

The results from all the above plots are shewn in Table No. I at the end of this report.

Sunflower Cotton

This variety formed the main crop on the Plantation in season 1913-14, and the seed from that crop was sown in a restricted area in Serere County during the year under review. This has given satisfactory results, and it will be further propagated during the coming year, the whole of Serere County being sown from this seed.

A sample of this cotton was sent to a Liverpool broker and received the following report :—"Roller ginned, bright good colour, staple $1\frac{1}{8}$ to $1\frac{3}{16}$ strong, much more readily saleable than the Allen." The ginning percentage of this cotton was 32.62%

Individual plants selected from the main crop of the previous year were sown in separate plots on the Plantation during the past year. The resulting crop was carefully examined in the field, and the best plots were selected for further propagation. These included Nos. 5, 7, 14, 15, 18, 20. A report on these selections is given on Table No. 2 at the end of this report.

General Remarks

The Allen Cotton has now been for two years in general distribution throughout the Protectorate, and the results are interesting. Both seasons differed widely in weather conditions, influencing the quality of the cotton considerably, although the yield was not so much affected.

In the year 1913-14 complaints were heard from the ginnerers that the cotton was weak and variable, and that the ginning out-turn was low. There were complaints from the Brokers in England to the same effect, and we were advised not to grow Allen Cotton in Uganda.

The reason put forward by us for the above results was that a drought during the growing period, viz., August and September, had

materially affected the whole crop, which shewed itself on the lint and seed. The lint was short, soft, and brittle, probably due to the drying up of the essential oil in the fibre, and the seed appeared to be shrunken and badly filled. The distribution of the lint on the seed was noticeable, the seed being practically devoid of lint at the micropilar end, and the seed readily broke up on ginning.

Coming to the year under review, 1914-15, we find entirely different weather conditions during the growing period of the crop. Instead of drought during August and September, heavy rains fell which continued until the crop was full grown, and which, though affecting the yield where the crop was very exposed, made all the difference in the quality of the lint, and verified the reasons put forward for the previous year's disappointing results.

Reports from the ginnerers shew that this year's cotton is a great improvement on that of last year. The lint is stronger, and the ginning out-turn is at least 2% better than last year.

A report from the Brokers on the cotton has not yet been obtained, but it ought to be interesting.

It has been shewn that Allen Cotton should not be grown in parts of the country which are liable to droughts during the growing period of the crop. As the Eastern Province is occasionally subject to these droughts, it has been decided to sow Sunflower, which is hardier and can stand the drought better, instead of Allen in this Province.

Other Crops

Small areas of Maize, Buckwheat, Sim-sim, Ground-nuts, Indian Gram, Rose-Cocus Beans, Pigeon Peas, Wimbe and Tobacco were grown. These were all grown on land after cotton, and, from some, good yields were obtained.

Maize

Two varieties.—Yellow Hogan and Hickory King, were grown and yielded 1380 lbs. per acre. The soil at Kadunguru, although suitable for cotton, is neither deep nor rich enough for maize, and only moderate yields can be expected. The quality of the Maize was, however, very good.

Sim-sim

The Sim-sim crop yielded 550 lbs. per acre. This, though better than the preceding year, will still be somewhat less than the average yield obtained from small plots grown by natives in the Lango District, where the soil and climate seem to suit Sim-sim better than that of Teso District.

Ground nuts

Ground nuts yielded 856 lbs. of unshelled nuts per acre. This may be taken as a fair average yield for the whole district.

Tobacco

One small plot only of pipe tobacco, "Lacks" variety, was tried this year. It was sown in the nursery in April and planted out in June. A type of soil differing from that of last season was selected, but the result was unsatisfactory. The soil tried was not suitable, being too poor and sandy and had previously borne cotton for two years. The season also was less favourable than that of the previous year, and heavy rain, with occasional hail during the harvesting month, September, did considerable damage. The leaf was spoilt to a great extent and was consequently not in good condition for the curing process. Owing to the damp and wet weather drying was slow, and the facilities being of a primitive nature, no good results could be expected. Fermentation was not successful—the small amount of leaf in good condition made a proper cure unlikely.

That Tobacco can be grown with some success at Kadunguru was proved last season, but necessary conditions include (1) soil suitably rich and (2) favourable weather. Protection from storms is necessary, and the field should be in as sheltered a place as possible. Wind-breaks should also be devised.

Buckwheat and Indian Gram

Buckwheat yielded at the rate of 660 lbs. per acre, and Indian gram 350 lbs. per acre.

Quantities of the above seeds have been distributed to natives in various parts of the Eastern and Northern Provinces, and it is hoped to increase the production of food stuff, and so prevent famine.

Sweet Potatoes

The ordinary native variety was grown for food stuff only. This is a very important source of food for the native, and some attention might usefully be given to the importation of new varieties, and by selection and propagation of the best and most productive types.

Agricultural Implements

During the past three years much time and labour has been spent by this Department in teaching the natives the use of the plough, and most of the chiefs in Teso District have had one or more ploughs at work on their shambas.

Unfortunately during the past year many of these ploughs have been laid aside, broken or worn out, and with no spare parts available to replace the broken or worn out parts, the result was that the enthusiasm with which the chiefs took up this work has been allowed to die away.

There are now five ginning firms operating with ginneries in the Teso District, and surely it will be to the interest of one or other of these firms to undertake repairs to agricultural implements, and to stock, not only the implements themselves, but ample spare parts of every kind, including draught chains and yokes for oxen.

Native Cotton Instructors

The native instructors in the Teso and Lango Districts were not materially altered during the past year. Some of these received increase of pay according to their efficiency. All of them visited Kadunguru from time to time to report. Their work was also examined on the spot at different times of the year, and was found to be generally satisfactory.

R. G. HARPER,

District Agricultural Officer.

Table No. 1.

REPORT ON THE EXAMINATION OF ALLEN COTTON FROM THE SELECTION EXPERIMENT PLOTS.

No. of original selection	Examination year 1912-13				Examination year 1913-14				Examination year 1914-15				Remarks
	Length of Staple	Strength	Percentage of Lint	Regularity	Length of Staple	Strength	Percentage of Lint	Transmission	Length of Staple	Strength	Percentage of Lint	Transmission	
3	1½	V. Strong	28	Regular	1¼-1½	Strong	27.2	Good	1¼-1½	F. Strong	29.5	F. Good	Not suitable for further propagation.
4	1 7/16	V. Strong	28	F. Regular	1¼	V. Strong	27.9	V. Good	1½-1¾	V. Strong	29	Good	Suitable for further propagation—seed naked and cotton easily ginned.
13	1½	Strong	28.4	Regular	1 3/8-1½	Strong	26.8	F. Good	1½	Strong	29.4	Good	May do for further propagation.
17	1 9/16	V. Strong	29.4	V. Regular	1 9/16-1½	Strong	29.1	V. Good	1¼-1½	Strong	30.5	Fair	Will be further experimented with.
25	1 7/16	V. Strong	30.5	Regular	1¼-1 7/16	V. Strong	27.6	Good	1½-1¾	V. Strong	31	V. Good	This plot gave the best results and will be further propagated.
51	1½	Strong	28.5	Regular	1 3/8-1½	Strong	27.6	Good	1¼-1½	V. Strong	29.5	Good	Suitable for further propagation.

Table No. 2.

REPORT ON THE EXAMINATION OF SUNFLOWER COTTON FROM THE SELECTION EXPERIMENT PLOTS.

2nd Year's Selection.

No. of original selection	Examination year 1913-14				Examination year 1914-15.				Remarks
	Average Length of Staple	Strength	Regularity	Percentage of Lint	Average Length of Staple	Regularity	Strength	Percentage of Lint	
5	1 $\frac{3}{8}$	V. Strong	F. Regular	33.7	1 5/16	F. Regular	Strong	32.5	Suitable for further experiment.
7	1 $\frac{1}{2}$	Strong	V. Regular	29	1 $\frac{1}{2}$	F. Regular	Strong	31	Suitable for further experiment.
14	1 $\frac{1}{2}$	Strong	V. Regular	27	1 $\frac{1}{2}$	V. Regular	V. Strong	30.5	Suitable for further experiment. This plot gave the best results.
15	1 7/16	V. Strong	V. Regular	27	1 $\frac{3}{8}$	Regular	Strong	30	Suitable for further experiment.
18	1 $\frac{1}{2}$	V. Strong	Regular	31.2	1 5/16	F. Regular	Strong	31.5	Suitable for further experiment.
20	1 $\frac{1}{2}$	V. Strong	V. Regular	27	1 $\frac{1}{2}$	F. Regular	V. Strong	30.4	Some short staples found which were rogued out. This plot has been selected for further experiment owing to its strength of fibre.

Annual Report of the Veterinary Division

For the year ending 31st March, 1915.

Office of the Chief Veterinary Officer,

Kampala.

The Director of Agriculture, Kampala.

Sir,

I have the honour to submit my Annual Report for the year 1914-1915.

Staff

Chief Veterinary Officer : E. Hutchins, M.R.C.V.S.

Veterinary Officers (4)

U. F. Richardson, B. Sc., M.R.C.V.S.,

W. F. Poulton, M.R.C.V.S.

R. L. L. Hart, M.R.C.V.S.

A. N. Foster, F.R.C.V.S.

Stock Inspectors (3)

F. A. Poestkoke

H. L. Lemon

H. Strauss

Veterinary Assistants (3)

H. Rahmatullah

Fakhar-ud-Din

Fazal-ud-Din Ahmadi

Clerk

J. X. D'Mello

I proceeded on short leave on the 13th July to attend the 10th International Veterinary Congress, which was opened in London on the 3rd August and closed on the 4th owing to the outbreak of war.

I returned from leave on the 2nd January.

Mr. Hart arrived, on transfer from the Veterinary Department of Northern Rhodesia, on the 4th April, and proceeded on special duty to East Africa on the 12th September.

Mr. Poulton was detailed for special duty on the 26th November.

Mr. Foster was appointed on the 11th August but rejoined the Army Veterinary Corps Territorial Force before leaving England.

Mr. Fakhar-ud-Din proceeded on special duty to East Africa on the 12th September and returned to the Protectorate for special duty on the 8th March.

Mr. Rahmatullah was on special duty from 2nd October to 2nd November.

Mr. Poestkoke was transferred as Stock Inspector from the Public Works Department on the 1st July.

Mr. Lemon was appointed on the 1st September.

Mr. Strauss resigned his appointment on the 31st May and was re-engaged on the 9th December.

Mr. Fazal-ud-Din Ahmadi arrived from India on appointment on the 28th October.

Diseases of Cattle

Rinderpest

BUGANDA PROVINCE.

MENGO DISTRICT, **Kiagwe Saza:** Rinderpest, which had broken out in Kiagwe in August, 1913, and had caused heavy losses East and South of the Sezibwa river, was successfully brought under control in Kiagwe by the end of May, when the infection was confined to one small centre at Katenti, which was stamped out in June.

Although the movement of all cattle, sheep, and goats in the infected areas had been prohibited and native meat markets closed, it was evident that the infection was mainly being spread by illicit traffic in meat from infected beasts which had died or were slaughtered by the herdsmen while suffering from cattle plague. The main objects sought in endeavouring to stamp out the disease in this area were, in

addition to the maintenance of a strict quarantine, to prevent as many deaths as possible by immunising all exposed to infection, by treatment of the naturally infected, and by ensuring the destruction by burial, or cremation, of all carcasses. By proceeding on these lines the epidemic was brought under control and stamped out in June, with the result that an area was formed, containing only immune cattle, along the only route by which the infection could spread westward without crossing the natural boundary of the Sezibwa river.

The cattle in Kiagwe remained free from rinderpest from June till September, when the disease again appeared in Eastern Kiagwe amongst those herds which had escaped infection during the previous outbreaks in 1913, the infection in all probability having crossed southwards from Bugerere through the game in the forest areas along the west bank of the Nile.

An inoculation camp was formed at Kisimba in Eastern Kiagwe where a constant supply of virulent blood was maintained by keeping the infection going in calves obtained locally for this purpose; at this centre 1250 cattle drawn from the surrounding neighbourhood were immunised.

Ham Mukassa, the Sekibobo, Saza Chief of Kiagwe, was unremitting during the year in his efforts to have the quarantine kept, and also to impress upon his people the great benefits of immunisation.

A fee of Re. 1/- is collected and paid in by the chiefs for each adult animal inoculated in this Province.

Bugerere Saza: Towards the end of June cattle plague was reported at Nazigo in Southern Bugerere close to the west bank of the Nile. The origin of the infection is not known. It may have been brought across the Nile from Budiope in Busoga; or, since it appears to be clearly established that the first animals affected in Bugerere were the bush pig, it is possible that the infection had maintained itself amongst the game in the areas in Eastern Kiagwe which have been depopulated for some years past on account of Sleeping Sickness.

Shortly before the disease appeared at Nazigo, cattle had died in Jinja, on the east bank of the Nile, from cattle plague, and some of the carcasses had been disposed of by being thrown into the Nile instead of being buried. It is quite possible that these became stranded on the west bank, further down stream, and that they brought about the infection of the pig near Nazigo.

It was found that bush-buck, bush-pig, and buffalo were dying in considerable numbers in Southern Bugerere and Eastern Kiagwe.

An inoculation camp was made at Nazigo and later transferred to Kyanya further north. Efforts were made to induce the owners of native herds throughout Bugerere to have their cattle immunised before they became naturally infected, but, until the last quarter of the year, only those cattle immediately exposed to infection were sent in for inoculation. Meanwhile the disease was slowly but steadily spreading northwards in the game, with the result that between 2,500 - 3,000 cattle were lost. It was reported that buffalo were not infrequent agents in spreading infection over considerable distances, as the lion are said to hunt these about when they are affected with cattle plague.

The number of cattle inoculated in Buganda during the year were as follows :—

District.	Adult cattle inoculated.	Deaths in Adult cattle.	Calves inoculated.	Deaths in calves.
Southern Kiagwe	267	11	63	6
Eastern Kiagwe	938	35	339	40
Bugerere	1853	150	446	164
Total	3058	196	848	210

All the above were immunised by the serum and virulent blood method, and the great majority of the cattle were branded after they had re-acted.

The infection had appeared in several of the herds in Bugerere before they were inoculated, which accounted for the higher percentage of deaths in that saza.

The method of using serum alone, and then mixing the cattle with sick animals on the system advocated in India, has not proved satisfactory. In most cases cattle so treated have remained healthy for three weeks to a month and then contracted the disease with no alteration of its virulence.

DRUG TREATMENT OF RINDERPEST: The use of Potassium Permanganate has given good results when used in early cases. Out of a total of forty-one cases, of which the results can be vouched for, treated by Mr. Richardson and Mr. Poulton there were 8 deaths and 33 recoveries. The average mortality from the disease if untreated is over 70%.

RINDERPEST IN GAME : Bush-buck bush-pig, buffalo, reed-buck and water-buck are all reported to have died from cattle plague, though no reed-buck or water-buck were found dead by Veterinary Officers or Stock Inspectors. Bush-buck suffered much more severely than other game, and 41 carcasses of this species were found dead round one water-hole. Two wild pigs were inoculated with blood from a cow with rinderpest. One pig died, the other sickened but recovered. A bullock, inoculated with blood from a sick Uganda cob, which was caught at Kyanya, and anti-rinderpest serum, underwent a typical re-action. It is interesting to note there is no record of cob being found dead.

Eastern Province

In the Eastern Province it had been hoped, on the arrival of the additional staff sanctioned, to attempt to bring disease under control, but the outbreak of war necessitated the removal of the veterinary staff in the Eastern Province for military duty. There has been only one Veterinary Officer available for work on rinderpest since October, 1914. Occasional visits were paid to the Province to immunise oxen in order to keep up the supply of transport oxen needed in the Province.

794 native-owned cattle were immunised during the year and 792 cattle were immunised for transport and slaughter purposes.

The cattle plague became widespread in the Lango District during September, October, and November ; this district had remained almost free since 1912 and a large number of the susceptible young stock was lost during the year.

In the Teso District this disease was also prevalent over large areas, but there appears to have been a very noticeable decrease in its virulency.

In the Bukedi and Busoga Districts the disease was widespread, but no estimate of the losses is obtainable. It is probable that the infection has become endemic in the game in Busoga.

Nothorn Province

The losses have not been so serious as in previous years ; a very large proportion of all the cattle having been swept off since 1910.

Western Province

Rinderpest has not as yet reached the Western Province, but the disease exists to the South near Muanza. Although very large belts of *Glossina Morsitans* intervene between Muanza and our border, in which there are no cattle, these belts contain numerous game through which the spread of rinderpest is often more certain and far more insidious and uncontrollable than in cattle.

Five years' experience of cattle plague in Uganda has shewn that with an adequate supply of serum and a trained staff with a knowledge of local customs and conditions, large numbers of cattle can be immunised simultaneously, and the losses can be reduced to a very low figure, and these principally in old animals or in the young calves.

The course of the epidemic in Bugerere shews that in a district in which game is numerous it is quite futile to rely on any system of quarantine, although this, if strictly enforced, greatly retards the formation of new centres of infection.

Trypanosomiasis

BUGANDA PROVINCE, KAMPALA: There was a serious outbreak of trypanosomiasis amongst the transport cattle in Kampala. Mr. Richardson's report on this is appended.

Dairy cattle in the Station, with a few exceptions, were not affected, and no cases in any other domesticated animals were found.

Some of the Public Works oxen, which had worked in Kampala for eight years, became infected. The question of the actual transmitting agent is still in question. Trained native fly-boys are now employed in making daily collections of all biting flies found on and in the neighbourhood of the grazing areas.

Hitherto *Stomoxys* have been by far the most common fly found. *Haematapota* have been very prevalent since the onset of the rains.

Tabanidae have not been brought in in any numbers. *Glossina Palpalis* has been taken about two miles from the station on the Nakivubo Swamp, both in the Mpanga forest and near mile 3 on the Luzira-Kampala Road, and near the Kampala-Port Bell Railway. It appears most probable that those cattle which were found infected with *Trypanosomes* of the *Vivax-Uniforme* group had been exposed to the bites of *Glossina Palpalis*. None of these flies have, however, been taken within two and a half miles of Kampala.

Except in Buruli, Trypanosomiasis of cattle in this Province has not caused the serious losses amongst native herds in the outlying grazing areas which were so marked in 1911 and 1912.

In Buruli 1,114 cattle out of 1,290 are reported to have died from Trypanosomiasis since June 1914. Owing to depopulation, many parts of that Saza are becoming overgrown with bush in which *Morsitans* would appear to be spreading.

WESTERN PROVINCE, ANKOLE : In Southern Ankole in the Sazas of Bukanga and Ngalama there has been a very marked increase in the numbers of *Glossina Morsitans* during the past two years. During my tour in Ankole in February and March I found the fly to be now very much more numerous in those parts where few were to be found in 1913, and it is extending rapidly into areas which have hitherto been free from it. Cattle, sheep, goats and dogs were all found to be infected. The Trypanosome most commonly met with was *T. Pecorum* in cattle and a Trypanosome of the *T. Vivax* and *T. Uniforme* group in sheep and goats.

Foot and Mouth Disease

I investigated an outbreak amongst some herds at Mbarara and found that foot and mouth disease was prevalent amongst them : the infection is supposed to have come from the north east and has been reported in Western Buddu. Except in transport cattle, the disease in this country is not of very great economic importance, as it seldom proves fatal.

East Coast Fever

Except in calves, this disease has not come much under notice during the year. A large proportion of a mob of cattle, brought from near Kamalinga in Karamoja country, where the disease is not endemic, died when moved to Soroti in the neighbouring Teso District. It is hoped that before long a dipping tank will be established in Kampala and a commencement made towards reducing the very large number of ticks which infest all domesticated animals in that station.

Diseases of Equines

HORSE SICKNESS : There were numerous cases of Horse Sickness amongst imported mules. Mules and ponies which had been for some years in the Protectorate were not affected, although exposed to infection at the same time.

LYMPHANGITIS : This disease has not caused such losses as in previous years.

INTESTINAL PARASITES : These have caused considerable losses amongst donkeys.

Diseases of Sheep and Goats

Scabies has for some years been causing heavy losses amongst goats in Ankole. Arrangements for periodical dipping of sheep and goats have been made at Mbarara.

Contagious Pleuro-pneumonia of goats is widespread and carries off large numbers when goats are moved from one district to another.

Diseases of Dogs

Piroplasmosis is endemic over the whole Protectorate, but, when cases are taken in hand at the early stages and receive the trypanblue treatment, deaths are now exceptional. A case of interest was one in a bull terrier pup which died untreated aged 28 days : the blood slides shewed an exceptional heavy infection of *P. Canis*.

Filariasis is very common, few of the native dogs being uninfected.

One case of Cutaneous Filariasis was met with in a retriever.

Exportation of Cattle

The supply of cattle for Rinderpest serum was interrupted from August till March, but then restarted. A number of wild bush-pig have been obtained by the District Commissioner, Busoga, and sent to the Veterinary Pathologist, Nairobi, for experimental work in connection with Swine Fever.

300 trade cattle, cows and calves actively immunised against rinderpest were exported to British East Africa during the year.

Importation of Animals

The following were imported during the year :

Cattle 330. Dogs 21. Mules 29. Ponies 2.

Kampala Slaughter House Returns

From 1st April, 1914, to 31st March, 1915.

1914.

Months.	Goats.	Sheep.	Cattle.
April	227	81	62
May	201	60	74
June	263	74	44
July	334	80	51
August	74	15	36
September	12	1	50
October	62	3	40
November	93	6	45
December	95	12	52
1915.			
January	143	31	62
February	217	26	46
March	174	41	50
Total	1,895	430	612.

Summary of slides Examined, Kampala, 2,362.

CATTLE		EQUINES	
Trypanosomes	366.	Mules Negative	1
Piroplasma	7.	Donkeys „	20
Anaplasma	4.	DOGS.	
Filaria	1.	Trypanosomes	29
Negative	1669.	Mange Parasite	7
SHEEP AND GOATS.		Filaria	32
Negative	27.	Piroplasma	27
GAME		Negative	167
Buffalo Negative	1.		

Cases Treated at the Veterinary Dispensary

Cattle 207.	Dogs	177.	Goats	28.	Mules	19
Ponies 4.	Sheep	2.	Fowl	1.	Donkeys	4.
		Parrot	1.			

Deaths in Government Live Stock

These, as occurred during the year in the various districts of the Protectorate are set forth in Appendix II.

Except in the case of the deaths in Kampala the causes of deaths were made by laymen.

The whole staff, Veterinary Officers, Stock Inspectors and Veterinary Assistants, have worked during the year with more than their usual thoroughness and interest in their work.

Mr. Richardson, who was acting Chief Veterinary Officer for the six months from July to January, had a trying and difficult task particularly as he had no Veterinary Officer to assist him in supervising the work of the Stock Inspectors, and had to deal with several widely separated outbreaks in the Buganda and Eastern Provinces.

E. HUTCHINS,

Chief Veterinary Officer.

Appendix 1

Report on Outbreak of Disease due to *Trypanosoma Pecorum* and *Vivax* in Kampala.

In September, 1914, 5 cattle belonging to A. Allidina Visram were brought to the Veterinary Office for treatment, and found to be infected with a small Trypanosome, found later to be *Trypanosoma Pecorum*. These cattle had been working on the road to Fort Portal, and were probably infected from the same source as the Transport Department's cattle working from Fort Portal to Kibale. The outbreak in Kampala may be considered a sequel to the outbreak at Kibale in the preceding March. The owner was advised to separate his healthy cattle from the sick ones, and the whole herd was examined microscopically, with the result that 8 infected animals were found. No very great importance was attached to the outbreak at the start, as cattle suffering from similar *Trypanosoma* had often been brought into Kampala before. About a week later, however, it was found other cattle had become infected, and many of these were animals which had not been working outside Kampala. The infection was evidently spreading in Kampala. Two cattle belonging to the Transport Department were also found infected, one of them having come from Kibale, and one bullock belonging to the Municipality was found infected with *T. Vivax*. Strict isolation of infected animals on Naguru Hill was then enforced, and periodical inspection made of the blood of all cattle in Kampala. Forty cattle belonging to Allidina were isolated in September, several cases of *T. Vivax* being observed, but the majority being infection with *T. Pecorum*. During October and November very few fresh cases were found, but during December a serious recrudescence occurred, unfortunately during my absence on tour. Weekly inspection of blood and isolation of the infected was again undertaken in the latter half of December and throughout January, and no fresh cases occurred after the beginning of February.

The following deaths have been reported :—

A. Allidina Visram	60 oxen
Messrs. Valji Bhanji	25 „
Municipality	27 „
Public Works	20 „
Transport Department	20 „
Cows belonging to Indians	3.

Animals still in Quarantine.

Municipality	3
Public Works	4
Transport Department	5
A. Allidina Visram	1.

Carrying Agent: It was first thought the infection must have been carried by *Glossina Palpalis* in the neighbourhood of Port Bell, but the infection of the Municipality cattle made that theory untenable. Owing to the presence of *T. Vivax* it was thought that tsetse must be held responsible, but most careful search failed to detect any.

The course followed by the disease resembled that described when mechanical transmission by the agency of *Tabanidae*, and possibly *Stomoxys*, was the method of infection. That is, although all the cattle were treated in much the same way and grazed on the same ground, they were not uniformly affected. Allidina's herd suffered first, followed later by the Municipal herd, then the Transport, and finally the Public Works. Also, so far as could be ascertained, no dogs, sheep or goats were naturally infected, though dogs were proved to be susceptible to inoculation.

TREATMENT: Fifty-two cattle were placed under various treatments including :

1. Atoxyl and Arsenious acid.
2. Soamin and Arsenious acid.
3. Atoxyl and Orpiment.
4. Soamin and Orpiment.
5. Orpiment alone in ball and as electuary.
6. Tartar Emetic by subcutaneous injection.
7. Arsenophenylglycin, Trypanblue and Tartar Emetic.
8. Arsenophenylglycin, Trypanblue and Orpiment.
9. Arsenophenylglycin alone.

Of these treatments Orpiment alone gave the best results, the Trypanosomes disappearing from the blood often for long periods and the animals improving in condition. Relapses, however, occurred in every case, and continuing the Orpiment every other day seemed to have no effect on preventing these relapses. The dose of Orpiment used was 8 grammes to 12 grammes, depending on the size of the bullock, it being estimated that the average bullock weighed about 400 lbs.

One case, treated with 10 grammes of Orpiment in ball on September 5th, remained free from Trypanosomes in the peripheral blood till October 10th, re-treated on October 12th it again remained free till December 7th, and finally died at the end of December. On the other hand, larger doses of the drug, singly or repeated every other day, gave no better results.

One case isolated as infected on September 24th was still alive and in fairly good condition on March 31st, and the disease in most cases is extremely chronic. In untreated cases the Trypanosome could practically always be found in the peripheral blood.

Experimental calf No. 5, inoculated with a strain of *T. Pecorum* on October 1st, 1913, showed Trypanosomes in the peripheral blood till January 1914. They were then absent till August, 1914, when they reappeared and remained prevalent till November, 1914, since when they have not reappeared.

U. F. RICHARDSON.

Veterinary Officer,

Kampala District.

APPENDIX II.
Deaths Reported Amongst Government Live Stock During 1914-15.

Names of Places and Districts.	Species of Animals.						Lymphangitis	Died on Safari (Cause unknown)	Cause of death not known	Trypanosomiasis.	East Coast Fever	Gastritis	Septicaemia	General Debility.	Gall Sickness	Distomiasis.	Inflammation of Lungs.	Anaemia.	Luku (Native Name)	Old Age	Mange	Destroyed by order of V. O.	Killed by Lion.	Carried away by Hyæna	Snake Bite	Born Dead	Unsuitability of Climate
	Bullocks	Cows	Calves	Sheep	Camels	Mules																					
Kampala	89					1	1	8	1	70	2	1	1		1	1		4									
Dokolo	23					1	1	18		2					2								1				
Kibale Toro Road	5							4	7	1																	
Kibale	13							4	2	2										1	2						
Bukakata	9		7					4	6																		
Masaka								1	1																		
Gulu									22																		
Kitgum	22	20	10						20																		
"			7						10																		
Entebbe	5	1							1	1	5															1	
"									2																		
"									2					3													
Jinja	7								2																		
Hoima	1								1																		
Mubendi				1					1																		
Kigezi		48							48					1													
Masindi	5									4	5																
Bombo	1	1	5																			1					9
Soroti					9																						
Total ...	180	71	29	1	9	2	2	35	124	81	12	1	1	4	3	1	1	4	1	6	2	1	1	1	1	1	9

Annual Report of the Government Botanist

For 1914-1915.

Since the beginning of August, 1914, when the Entomologist went on leave, I have been in charge of the Entomological as well as the Botanical work of the Department. These two branches of work form the subjects of separate reports.

The following report deals with my second year's work. My duties have been entirely mycological, and records of the various cases of plant disease dealt with during the year under review will be found under the headings of the different crops. For the most part, diseases mentioned in last year's report have again been under examination. As time advances, it will be found that certain troubles are more universally distributed throughout the planting districts, and that others occur only sporadically. With the exception of Cotton, Coffee is the most widely planted and the oldest established crop, and its diseases take first place in point of importance. With the increase of the area under Cacao, the diseases of the crop are likely to be more prevalent in the future than they have been in the past. It must be remarked that, at present, they are infinitesimal in both their occurrence and the loss they cause. Para rubber trees are also remarkably free from fungoid diseases, and Cotton is even more so. The area under Cotton is large, and, under ordinary circumstances, is increasing from year to year. The paucity of diseases is a matter for congratulation.

Coffee

Leaf Disease (*Hemileia vastatrix*. B. et Br.). On the whole, the situation as regards *Hemileia* disease is quieter than ever before in the planting history of Uganda. The original alarm has subsided, and its place has been taken by a quiet confidence in the future of Uganda Coffee. Signs of a lessening of the virulence of the disease were displayed towards the end of 1913, and over the early months of 1914, and the hopes then raised of the actual *disappearance* of *Hemileia* have been largely realised. On estates where formerly every Coffee leaf showed at least six *Hemileia* infections, one has now to examine with care from four to six trees in order to find a diseased leaf.

This state of affairs is not by any means due to the use of fungicides, or to the employment of careful cultural operations, for, on the great majority of estates, neither spraying nor pruning has been taken in hand. Spraying has been steadily advocated as a *preventive* measure, particularly

for young estates, but the suggestion has not been widely adopted. Several older estates which were ravaged by *Hemileia* have made a regular practice of spraying since the advice to spray was given, and are now in excellent condition. It is claimed that the estates have been in many ways benefitted by the work done, apart altogether from the results of the direct attack on *Hemileia*, and the claims seem to be borne out by the facts. But, on the other hand, many estates which have done no spraying, and which were in an equally bad case, are now in equally good condition. It is to be hoped that opportunities for observation of *Hemileia* under these two sets of conditions will be continued for several years.

In view of these facts and of the statements in a following paragraph, it is very doubtful if the spraying has been the direct cause of the reduction in the virulence of the disease. It seems as if the 1913 epidemic had run its course. It will be interesting indeed to note how long the present state of affairs will be continued.

On many of the younger estates, *Hemileia* has made, or is now making, its appearance, and it will, in all likelihood, repeat its behaviour of 1913 on the older estates. It is unfortunate that planters wait until the appearance of the disease before they take steps to combat it. The only thorough method of doing so is to spray from the beginning, that is, to begin with the young plants in the nurseries, and to continue at definite and suitable intervals after planting out and during subsequent years.

Spraying experiments (which would have been more numerous, if difficulty in obtaining materials had not been experienced) were carried out in December, 1914. The sprays used were (1) copper sulphate, soda-ash, in water, 20-9-100, (2) copper sulphate, calcium carbide, in water, 4- $\frac{3}{4}$ -40, said to be efficacious in British East Africa, and (3) copper sulphate, washing soda, in water, 4-4-40. A second application of the calcium carbide mixture was given a fortnight after the first. The rainfall of the two weeks immediately preceding the dates of spraying was 1.1 inches. The number of trees sprayed with each mixture was one hundred and fifty, and the percentage of diseased leaves present was taken as twenty-five. Equal-sized control plots with an equal amount of disease were established. The period following the spraying operations was one of low rainfall. Mr. Maitland, who carried out the work, reported that, within four to six weeks after the spraying, all the trees shed their leaves and produced a fresh lot. There was thus no opportunity given for observing the effects of the sprays used.

No other leaf-diseases of Coffee are known in Uganda. *Colletotrichum coffeae*, Masec, reported in 1907 by Dawe, may be in the country, but it has not been met with. It was remarked in *Der Pflanze* of March, 1914, that it was questionable whether Uganda Coffee leaf-disease was due to *Hemileia* or to this *Colletotrichum*. There was no justification for the remark, seeing that a report on the position of *Hemileia* in Uganda was sent to the German East Africa Government in December, 1913.

It has not been possible during the year to investigate the *aecidium* of *Hemileia*, beyond making an examination of a few *Rubiaceous* plants. This line of work would doubtless lead to results of far more scientific interest than of practical value to the planter.

Die-back: Almost a hundred examples of this Coffee trouble have been examined in the laboratory during the year. In many estates this die-back has caused a serious loss of trees, and in others a serious loss of bearing wood, and, therefore, of crop. On the older estates, it was most common when *Hemileia* disease was at its worst and afterwards, and there is always a certain amount of it on all plantations.

The tips of affected branches blacken, and the leaves fall; the berries very often remain on the branches, but they become brown and do not mature. At first, only a few branches are affected. These may occur at different levels in the centre of the tree. A further stage shows the gradual drying-up and death of practically all the primary branches, situated above the oldest primaries at the base of the stem and below the young green apical shoots. Thus is produced a tree with a lower mass of well-developed leafy primary branches, an upper crown of fresh green shoots, and an intermediate area which is naked, barren, and unsightly, and consists of projecting primaries which have lost all interest in life.

This condition is the result of physiological causes, and is not due to fungoid attack. It was thought at one time that "die-back" trees were affected by a bark-disease, caused by a fungus of the nature of the *Corticium* which attacks *Hevea* and other crops, but this idea has been entirely departed from. The following two paragraphs may perhaps give an explanation of Uganda Coffee "die-back".

During the first years of the Coffee-tree's growth, the basal primary branches, which are the oldest, are enabled to make good secondary growth and thoroughly to establish themselves. Therefore, when flowering and bearing commence, they are able, by their own efforts, and with the help of their secondary branches, to ripen their crop and survive the ordeal. The young apical primaries bear no crop, and they, having no extra strain

put upon them and having to hand their full share of sap, continue to grow and increase. The intermediate mass of primary branches—the ones which die back—find themselves unable, of their own unaided efforts, to ripen the large maiden crop they invariably bear. They are not yet well-established, and they collapse under the strain put upon them. Inspection of a coffee tree in this condition shows that some of these primaries succeed in ripening their whole crop and then die, while others, after ripening only a part of the berries, give up the effort to do any more. The dead branches are lost for ever to the tree. Others which survive may linger on for some time, with, as a rule, only one apical pair of leaves. In this way, a gap in the symmetry of the tree is made, and, should the same effects follow the incidence of the next flowering season, an exceedingly useless and unsightly tree is produced.

The Coffee “die-back” is thus to be regarded as the direct effect of a form of over-bearing, and, on this assumption, the following measures are recommended.

Where “die-back” is common, and it is desired to adopt remedial measures, these should take the form of stumping affected trees. The cut should be made through the stem at the top of the basal portion which bears the healthy primary branches. A new sucker can be raised from this stump, and the tree restored in time to its normal shape.

Preventive measures are strongly recommended to those who are able to adopt them. They consist in the prevention of over-bearing by the branches under discussion by relieving them of their maiden crop. The young berries should be pulled and rubbed off the trees. This operation is best performed within a month after flowering. If it is carried out too soon after the flowering, a set of new buds will be produced, and if it is delayed until the berries are well-grown, and the bearing branch shows signs of sickness, the benefit of the operation is lost. The harm is already done, and the branch is in the grip, so to speak, of the “die-back”.

The carrying out of this operation on a fair-sized estate will undoubtedly prove costly, but it will most likely require to be undertaken only once, and that during the second or third year of the plant's life, and only on those branches that attempt to bear on green wood. Expense and loss of crop (the latter being negligible because the lost berries would not, in any case, come to maturity) will be repaid by the development of naturally and symmetrically branched trees, and the subsequent evenness of crop borne. Secondary and other branches can be replaced, but lost primaries *never can be*.

In this connection, it is to be regretted that the operations of removing from young trees all tender superfluous growths, of systematic pruning of older trees, and of keeping clear around the main stem a cylindrical vertical passage a foot in diameter by removing secondary branches, are not more frequently carried out. Good cultivation is also necessary.

The fungi found on "die-back" trees are *Periconia byssoides*. Pers., *Fusarium coffeicola*, P. Henn., *Phoma* sp. (probably new), *Fusarium* sp., *Tubercularia* sp. and a *Colletotrichum*. The first-mentioned form and the two species of *Fusarium* were also found on young trees killed by lightning. The *Phoma* and the *Tubercularia* were found only once. None of these species is constant in its presence on "die-back" branches, and other imperfect forms found only very occasionally are not suggestive of parasitism. These fungi are undoubtedly only saprophytic.

The foregoing remarks do not bring into the question of the prevalence of die-back a factor which has undoubtedly had a great influence upon it, the baneful effects of *Hemileia* disease—the loss of leaf-surface and the consequent reduction of the working efficiency of the weakened tree. Branches which never bore or attempted to bear any crop have died back solely because of their loss of leaves and the general low condition of the parent tree caused by the demands made upon it by the necessity for renewal of a lost or damaged leaf-system. Die-back, again, is favoured when weeds have been allowed to interfere with the nutrition of the trees, where the soil is poor, and where a period of drought has been experienced, the last being the case in certain districts immediately after the epidemic of *Hemileia* which lasted over 1913. Like *Hemileia* itself, it is not at present so much in evidence as it was during 1913 and the earlier part of 1914. In other words, many trees have "recovered", but the planter is still faced with the fact that, owing to the loss of primary branches, he cannot take from his trees the full crop they ought to yield.

Brown Root Disease (Hymenochaete noxia, Berk.)

Numerous examples of this disease have occurred during the year. In a few cases, its presence has been difficult to account for, but, in the others, the fungus has been traced to a source, usually a decaying stump or log. It cannot be said that the disease has caused, or is likely to cause, serious losses, but the necessity for clearing out stumps and roots from a planted area involves a much greater expense than that of thorough initial clearing. Besides, the operations interfere with a growing crop. In one case, roots over eight feet long have had to be removed, and, in others, the

work had to be done at a time when the labour was required elsewhere. Attacked trees have never recovered and much time is lost through the sacrifices of trees in bearing.

For the information of planters, it may be mentioned that the mycelium of *Hymenochaete noxia* is not capable of travelling independently through the soil. An infected stump will not infect a tree unless it be in contact with the roots of the latter. Therefore, *Hymenochaete* is not found on young Coffee, but is confined to older trees which have had time to develop a spreading root-system, and have so established an underground connection with infected timber that may have been left in the soil. The fungus has been found on various unidentifiable stumps and roots.

The most apparent characteristic of the disease is the presence of a crust of soil and small stones on the affected root. This crust is held together by the mycelium of the fungus ; it may extend up the stem for a few inches. In the earlier stages of the disease, the mycelial threads can be seen if the crust is carefully examined ; in the later stages, the general colour of a diseased root is black.

As already mentioned, attacked trees do not recover because the hold of the disease upon them is too great by the time it is discovered. The removal of all the parts of a dead or dying tree ensures the removal of all the fungus attacking that particular tree. To clear thoroughly of the fungus, all stumps and roots must also be removed. Areas known to contain *Hymenochaete* should be isolated by a trench, dug over, and treated with Fungal or lime.

In one case determined to be due to *Hymenochaete noxia*, a small area containing five trees was affected. These were experimentally treated with Fungal, with the exception of one tree which was left as a control. The Fungal was worked into the soil in quantities of one and half a pound. No recovery took place. It is possible that the very timely application of Fungal accompanied by the removal of diseased parts might prove a curative measure, but the presence of the disease is seldom discovered until the tree is doomed.

No fruiting specimens of *Hymenochaete* have yet been encountered.

A flowering-plant parasite : Only one example of a phanerogamous or flowering-plant parasite of Coffee has been brought under notice. When received, the specimen was far from fresh, and was so damaged that identification was impossible. The parasite consisted of a single stem protruding from a primary branch of a tree about three years old ;

it pursued a path parallel to that of the nearest secondary branches. The junction of parasite and host was marked by a swelling, a dissection of which (unfortunately ruined by rats before completion) showed that the haustoria or "roots" of the parasite had encircled the wood of the coffee branch, and, in so doing, had raised the overlying tissues and formed a kind of chamber, the interstices of which were filled with soft corky tissue.

The one leaf remaining on the parasitic stem when it was received resembled the leaf of *Loranthus entebbensis*, Sprague, a species described from Uganda, and it is likely that the parasite under discussion was of this or a closely allied species. Several species of *Loranthus* are found in the country, and it will not be surprising if at least one species of an order of plants, many of whose members are omnivorous in their choice of hosts, shows a preference for Coffee. *Loranthus usambarensis*, Engl. occurs on Coffee in German East Africa.

Strictly speaking, the plant under notice is only semi-parasitic; it is able to assist in its own nutrition through the agency of its green leaves.

Treatment consists of the removal of attacked parts from a point below the union of host and parasite.

Soot Mould: The black covering of leaves and stems known as "sooty mould" is due to the presence of a superficial non-parasitic fungus, *Capnodium brasiliense*, Putt. It is harmful because of its habit of growth; it covers and smothers, and so interferes with the normal activities of leaf and green stem. It follows in the wake of certain scale-insects. *Lecanium viride*, Green, *L. africanum*, Newst., *Pseudococcus citri*, Risso, and *Ceroplastes singularis*, Newst., the two former of which are well-known Uganda coffee pests. I have found this sooty mould also on Guava and Castilleja leaves, and on the experimental plots of coffee grown by Bugishu chiefs on the foot-hills of Mt. Elgon.

An attack seldom extends beyond a few trees, and it is possible in many cases to rub both the fungus and the insects off the trees, and so get rid of them. Spraying, when resorted to, is done with a whale-oil soap solution which has been shown especially fatal to the above-named species of *Lecanium*.

The mid and lower parts of the tree are most harassed, owing, no doubt, to their being in a more favourable position as regards exposure and moisture than the upper parts, and the fungus occurs to a greater extent on the upper surface of the leaf than on the lower. It is not,

however, confined to the former. Of the various conidial forms of this *Capnodium*, the *Coniothecium* is commonest, spermatia-bearing spermogonia are much more frequent than perithecia with asci

Abnormal flowers : The first irregularity in the flowering of Uganda Coffee was recorded in January last. At that time, I was absent on tour from the district where it occurred, and was unable to inspect the flowering in the field.

I am indebted to Mr. Dümmer, of Kipayo Estate, for preserved specimens. The imperfect flowers were confined to a few estates, and were succeeded after a few weeks by a normal blossoming. The latter I saw towards the end of February, when I was enabled also to gather a few withered examples of the previous flowering. These flowers had well-developed stamens, but no pollen had been shed owing to non-dehiscence of the anthers. Fertilisation by their agency was thus impossible. The gynoecia were perfect and the stigmata were exposed.

The preserved material consisted of some examples similar to the above, and of others with an unopened corolla, and the whole lifted up by growth of the style. The stamens had not dehisced, and both self and cross-pollination were impossible. The ovaries were firm, slightly swollen, and apparently "set". I understand that experiments have been carried out. It will be interesting to know whether a parthenogenetic development takes place.

Cacao

As already remarked, Cacao is very free from fungoid diseases. There have been received during the year only three cases of die-back, two cases of pod-disease, and one of root-disease. Doubtless there have been many other cases unreported.

Die-back : The three cases were obtained from the same estate and were alike in symptoms. The affected trees had been grown under banana shade and were about five years old. The extremities of the dead branches were dry and withered, and the dead wood was of a dark grey colour. In two of the cases, the fungus had not reached the main stem : in the other, it had progressed from the top-most branches on one side of the tree down for a considerable distance into the trunk. Microscopic examination of tissue taken from the point where the diseased wood passed over to the healthy wood revealed the presence of hyphae, which were, in part, brown in colour. The *Diplodia* spores of *Thyridaria tarda*, Bancroft, were borne profusely in all three cases, and this fungus was undoubtedly

the cause of the die-back. *Thyridaria tarda* is generally recognised as a wound parasite ; that is to say, it is unable of itself to force its way into, and become parasitic upon, the unbroken tissues of a healthy plant. There were on these trees no wounds that might account for the presence of the fungus : it is probable that the tender tips of the branches had been injured by exposure.

The attacks of this fungus are not serious, but it is expedient to point out that its presence amongst crops is a danger to be guarded against. The statement that the fungus is present on his estate can be verified by the planter if he will examine dead timber, such, for example, as is laid down to make wooden bridges over drains. The fungus is found on such logs in the form of a black sooty powder which can be easily rubbed off with the fingers ; this powder consists of the *Diplodia* spores referred to above. These spores are *infective*, producing die-back, not only of Cacao but also of *Hevea*.

Affected limbs should be cut off at least six inches behind the advancing edge of the diseased part. When the main stem is attacked, excision should be practised. If the removal of dead and diseased tissue is likely to render the tree liable to be broken over, it is advisable to dig it up. General sanitary measures such as draining and treatment of wounds, and cultural operations such as protection of the trees from wind, pruning, manuring, and mulching, are always to be recommended.

Pod Disease : One pod, when received, was dry and hard, the shell being black, thin, and brittle. The placenta and seeds were loose and shrunken. On the surface of the pod were numerous protuberances which had evidently been perithecia. The ostiola were apical, and the contents were nil. A pycnidium of more recent date occurred in large numbers, the spores being hyaline, elliptical, and corresponding to those of the *Cytospora* form of *Thyridaria tarda*, the cause of the die-back. A mass of two-septate *Diplodia* spores of the same fungus was found on another part of the pod. No other fungi were present. These indications point to *Thyridaria tarda* as at least part-author of the damage. Experimental work designed to determine whether this fungus can alone produce a pod disease will be undertaken, when material is available.

In the other case, two pods were received. They were taken from the same tree and had grown in proximity. Each was yellow-green at base and apex, and light-brown shading into a darker-brown and black in the intermediate part. Near the apex of one of the pods was an area of about one inch in diameter, soft, wrinkled, sunken, dark-brown in colour, and covered around its edge only with acervuli of *Colletotrichum incarnatum*,

Zimm. The centre of this area was black, free of the *Colletotrichum*, and surrounded by a raised lip. A spot similar in all respects to the one described occupied a position equidistant from apex and base of the other pod. Sections showed that the diseased tissue extended into the pod shells to varied depths at different points, and that the degeneration produced was most marked immediately below the blackened spot just described. Here alone did it extend into the seeds.

These pods were placed under suitable conditions, and there developed upon the black spots, after the lapse of three days, erect masses of sporangia-bearing hyphae. These hyphae spread over all the diseased area of each pod after five days, and oögonia were found amongst them and also in the underlying tissues. This fungus is *Phytophthora Faberi*, Maubl., and is recognised as the cause of both *Hevea* and Cacao canker and pod disease. The tree from which the pods were taken was examined for canker, with negative results. Nor has any canker been found on Cacao or *Hevea* during the year under review.

The present scarcity of stem and pod diseases in Uganda Cacao may induce a feeling of false security among planters, and perhaps a word of warning may not be out of place. There is no doubt that potentially dangerous fungi are present in the country, and that they will in time make their presence more or less manifest. Preventive measures against a possible future danger should be adopted *now*. They should consist of spraying at regular intervals, improvement of shade, to take the form of gradual substitution of permanent shade for the bananas so extensively used at present, control of shade, the ideal shade being as light as possible, collection and burying of all diseased pods, and keeping a look-out for stem and pod diseases.

The necessity for the destruction of diseased pods should be insisted upon. Every diseased pod left on the tree or allowed to lie unattended to on the ground is a source of further disease infection. Pod-shells should be similarly treated.

Root Disease: Only one case of Cacao root disease was brought under notice. The above-ground appearance of the affected tree was such as usually accompanies root disease.

Examination disclosed masses of a compact white felt-work which had insinuated themselves between wood and cortex on all the lateral roots. This felt-work was easily stripped away; the lateral roots were firm and damp to the touch. The tap root showed a similar condition,

except that the felted mass was of a brownish instead of a clear white colour. The wood was friable in parts, and was invaded along the medullary rays by the felted plates. An examination of these plates before and after maceration in several fluids (potassium hydrate, 30% alcohol, and potassium permanganate solution) showed them to be made up of strands of mycelium closely aggregated and arranged lengthwise. These strands were composed, in turn, of finer threads. In parts, a honeycomb structure prevailed, the lacunae being spanned by a loose irregular network of very fine threads which stained more lightly than the surrounding bundles of mycelium. The hyphae were sparingly septate and of an average diameter of .0002 mm. The fungus remains unidentified ; no fruiting structure has been produced to date.

The source of this root disease was probably in the remains of former cultivation. The tree was growing in what was an old native garden. After its removal, the soil was treated with Fungal. Replanting has not yet been undertaken.

Para Rubber (Hevea)

The case of *Hevea* is similar to that of Cacao, inasmuch as its diseases are few. It is worthy of note that in only one instance has *Hevea* been interplanted with Cacao.

Root Diseases : The only genuine root disease encountered so far is *Hymenochaete noxia*, Berk. Its occurrence is sparse, and it is easily dealt with. The remarks made concerning Coffee root disease due to the same agency apply to this root disease of *Hevea*.

A doubtful case was that of two young trees which showed on their tap roots the purple-violet mycelium of a species of *Helicobasidium*. These trees were rough and warty at the collar ; the tap roots were bent, and the laterals stringy and ill-grown. The mycelium was sterile and probably only saprophytic. The trees were in poor condition, the stems being elongated, branchless, and withered at the tips.

Die-back : This trouble has occurred occasionally. All cases have been typical in the symptoms shown. Affected branches lose their foliage and degenerate into bare and dry sticks. In two cases, the causative fungus had entered by wounds. One was the end of a broken branch, an inch and a quarter in diameter ; the origin of the other was not clear. In another case, the invading fungus had gained a footing in the tissues of the apical shoot of a young tree and had advanced downwards into the main stem.

Wood killed by the die-back fungus is dark-grey in colour ; in cross section, this discolouration extends through part only of the wood in the form of a more or less complete sector of the whole circle. Besides the fructifications of *Thyridaria tarda*, Bancroft, *Phyllosticta ramicola*, Petch, and *Phoma heveae*, Petch, were present. It is remarkable that no traces of *Gloeosporium alborubrum*, Petch, mentioned in last year's report have been found, although the characteristic browning of the bark was present.

Hevea canker has not been reported. This is probably due to the fact that the majority of the trees in the country are not being tapped, and that, therefore, cases of canker, if any, exist unnoted.

Ceara Rubber (*Manihot Glaziovii*, Mull.-Arg.)

This crop is more or less in a position of neglect, and one seldom hears any disease or pest connected with its name. Untended trees, particularly those planted by roadsides, are very often attacked and ruined by the flowering-plant parasite *Loranthus entebbensis*, Sprague.

Cotton

Areolate Mildew : This is the only recorded cotton disease in Uganda. The causative fungus is *Ramularia areola*, Atk. The specimens were received from Busiro with a note to the effect that the fungus occurred chiefly on young plants. The attack seems to have been slight. The fungus is confined to the leaves, and affected areas have a frosted appearance due to the production of fruiting hyphae. In general, this *Ramularia* is not a dangerous parasite, but it sometimes causes loss through premature leaf-fall. It is known in the United States and West Indies.

Wheat

Rust : *Puccinia graminis*, Pers., occurs on wheat grown in Toro district. It has probably been in the country for some time although only recently noted. The "*kyoya*" variety is said to be more resistant to rust than the "*kabumbwigo*" kind, on which the parasite was found, but has gone out of favour because of its poor milling qualities. Wheat cultivation is confined to Toro and is in native hands, with the exception of a few plots grown by European planters.

Both the above-mentioned cases were brought under notice, and notes were supplied by Mr. Snowden, Assistant District Agricultural Officer, who collected specimens while on tour. Similarly, during a tour in the S. E. Bugishu district, I noted a smut on the maize cultivated by

the natives as a food-crop. This is the well-known head-smut of maize *Sorosporium reilianum* (Kühn). McAlp. The percentage of affected plants was not high. I was unable to obtain particulars of loss caused by this smut in previous years. As is usual in native agriculture, no attention is paid to its presence. I have neither seen it in, nor had any record of it from, any other part of Uganda. Instructions were given to the native agricultural instructor of the district to have diseased plants burned.

Sorosporium reilianum is a serious pest in Australia, and is known in the United States of America and in South Africa. It is, in fact, widely distributed and occurs in Japan, India, German East Africa, Madagascar, Egypt and Southern Europe.

GENERAL

Another smut, *Ustilago digitariae*, Rabh., is common on an indigenous grass, *Digitaria horizontalis*, Willd. (*kuku*). A similar smut occurs on *kasibanti* (*Eleusine indica*, Gaertn). Practically all the bananas in native gardens are affected with a leaf-parasite, *Fusarium* sp. *Puccinia cymbopogonis*, Masee, is very common on Lemon Grass, while *Uromyces appendiculatus* (pers.) Link., occurs frequently on the beans (*Vigna* spp.) grown by the natives under the names of *mpindi* and *kimokoti*. The same fungus, accompanied by two others, one of which is *Sphaerella crotalariae*, is common on *Vigna sinensis*, *V. catjang*, and *Pueraria phascoloides*, grown as cover-crops on the Government Plantation, Kampala. The seeds of these were obtained from Java. The harm resulting to these crops is considerable. *Fusarium heterosporum*, Nees, occurs on several indigenous grasses, but is not widely spread, and causes no harm to fodder plants.

Occasional examples of branches of different crops damaged by hail are sent for examination. They usually show large open wounds, the edges of which are composed of dead tissue, in which fragments of saprophytic fungi are found; the whole of the cortical tissues of the injured part may be decayed, and the wood exposed. The proportion of wounds that heal is very small, and the best course is the removal of badly broken branches from the trees.

Several useful additions were made to the library during the year, and, in February last, a move was made into new premises. These are situated near the office of the Director of Agriculture. The advantages of the greatly increased accommodation are already felt and much appreciated.

Few flowering plants have been collected during the year, but considerable additions have been made to the collection of fungi and other cryptogams. These have been named through the kindness of the Director of the Royal Botanic Gardens, Kew, mounted, and placed in the herbarium.

for reference. I have been much indebted to Mr. R. A. Dümmer, Kipayo Estate, for duplicates of fungi not in my collection, and to Mr. Maitland for specimens collected by him.

A large number of estates has been visited during the year, and tours have been made in Mubendi, Busoga, Bukedi (Bugishu), and Teso districts. A visit was paid to the Kadunguru Cotton Farm in December, 1914.

Circular No. 1 of the Department entitled "Coffee Leaf Disease" was issued locally in May, 1914, and an article dealing with Coffee cultivation in Uganda was published in the Bulletin of the Imperial Institute, April-June, 1914. Material for further circulars is being gathered, and it is hoped that the information they may give regarding local fungoid diseases will be of interest and benefit to planters.

A useful piece of work, viz., the indexing, on the card system, of the periodicals in the library of the Department has been carried out. Reference is now facilitated to the many valuable articles which deal with subjects on which no books are available.

During the year under review, I have continued to act as Secretary of the Buganda Plant Pests Board.

WILLIAM SMALL,

Government Botanist.

Annual Report of the Government Entomologist

The Entomologist went on leave at the beginning of August, 1914, and, since that date, I have been in charge of his work. Owing to the pressure of other duties, it has not been possible to undertake many investigations. Work has consisted mainly of the identification and combating of the various pests which have been reported by planters. An account of these will be found under the headings of the different host-plants.

Coffee

The Mediterranean Fruit Fly (*Ceratitis capitata*, Wied.) was not reported frequently during the year.

The Berry-Borer (*Stephanoderes coffeae*, Haged.) has not been brought under notice frequently, but there is no doubt of its presence on practically every coffee estate. At the Entomologist's suggestion, spraying experiments were carried out. Three similar lines of Arabian Coffee and three of Robusta Coffee were treated as under, after attacked berries had been removed from the trees.

C. arabica

Line No. 1. Chromate of lead (3 lbs. to 100 gallons of water)

„ No. 2. Control, unsprayed.

„ No. 3. Arsenate of lead (3 lbs. to 100 gallons of water)

After the lapse of two months the infected berries numbered,

Line No. 1. — 270

„ No. 2. — 380

„ No. 3. — 292

C. robusta. Same as in the case of *C. arabica*.

Line No. 1. Chromate of lead (3 lbs. to 100 gallons of water)

„ No. 2. Control, unsprayed.

„ No. 3. Arsenate of lead (3 lbs. to 100 gallons of water)

After the lapse of two months the infected berries numbered,

Line No. 1. — 362

„ No. 2. — 813

„ No. 3. — 308

The *Coffea robusta* series was thus more successful than the *arabica* series. These results, however, are not sufficiently good, and the experiments will be continued. Planters will probably find it worth while to spray twice during the bearing season with either of the above insecticides.

The first application should be given as soon as the berries are sufficiently advanced in growth for the beetle to attack them, and the second from three to four weeks later.

Specimens of coffee berries attacked by the larva of a small *Lycaenid* butterfly have been received from time to time.

Stem Borers. Both the Yellow-headed Coffee Borer (*Dirphya* (Nitocris) *princeps*, Jord.) and the Bostrichid Borers (*Apate indistincta*, Murr., *A. monacha*, F.) have been reported during the year. Full accounts, of these pests have been given in former reports. It only remains to be added that the carbon bisulphide or carbon tetrachloride treatment for the former, and the benzene treatment for the latter, have been successful. Reports of the former have been less frequent than during the previous year and fewer in number than those of the Bostrichid Borer.

Leaf-eating Insects. The larvae of *Metadrepna glauca*. Hmp., and of a *Parasa* continue at intervals to defoliate coffee trees. Their attacks are best checked by the use of a Paris green spray. In cases, the appearance of the former pest may be looked for on a certain part of the estate and at a certain time of the year, and materials can thus be held in readiness for combating it.

Scale Insects. At least a dozen species of scale-insects are known to infest Uganda coffee. Perhaps the most commonly occurring species are : *Dactylopius* (*Pseudococcus*) *citri*, Risso., *Lecanium viride*, Green., *Lecanium africanum*, Newst., *Stictococcus gowdeyi*, Newst., *Ceroplastes ceriferus*, And., and *Aspidiotus* (*Selanaspilus*) *articulatus*, Morg.

Whale-oil soap and kerosene emulsion sprays are used with success against these pests. A reference to the Botanical Report will shew that certain of these insects are accompanied by the Coffee Sooty Mould fungus.

Cut-Worms. These pests (*Agrotis* spp) have been fairly prevalent during the year. They can usually be found within a radius of four inches from the base of the attacked stem, and at a depth of three inches, and it is therefore the best method of control, on the small scale on which they usually occur, to have them searched for and destroyed daily by juvenile labour. A bait consisting of a mixture of 25 lbs. flour, 3 lbs. sugar, 1 lb. arsenate of lead, in 3 gallons of water is recommended. This bait should be spread around the base of the trees.

Ants. Several reports of damage by ants have come to hand. White ants, which sometimes bark the trees and so expose them to damage from winds, can be dealt with as advised in "Insects injurious to Economic Products", and stem-climbing kinds can be deterred by a *very* light coating

of tar applied to the stem. Ants are often associated with scale insects ; in such circumstances they confine attention to the insects and do not injure the trees.

Crickets. Three species of crickets are known to attack local coffee. One form is blackish in colour, lives on the surface of the ground under shelter of leaves and other debris, and makes a short burrow which it does not habitually occupy, but which it uses as a retreat when disturbed. The second form is brown, and resembles the first in appearance and habits. The remaining form is remarkable for its powerful toothed forelegs by aid of which the burrow is made. During the hot weather, this cricket penetrates deeply into the soil, and, during the rains, lives nearer the surface.

Light shading and good drainage of nurseries are essential factors in the prevention of cricket attacks. Traps consisting of small heaps of leaves or other rubbish should be set for the two first mentioned species, visited at mid-day, and the crickets found sheltering destroyed. Against the third species, a repellant consisting of a mixture of two pints of kerosene with a kerosene tin full of sand should be used. Against all three, a poisoned bait consisting of flour sweetened with sugar and mixed with Paris Green may be employed with success. It should be placed near the burrows of the crickets.

Root-Borer. One example of a coffee root-borer has been received. The pest is uncommon, and is probably the larva of a beetle, *Phloeocobius castenatus*, Koeb. The attacked plants were growing in bananaleaf pots in a forest in readiness for planting out during the rains.

Coffee Root Scale Insect. This pest has been found in different parts of the country. On one estate, it may appear here and there on only a single tree, or on a small group of trees. Affected plants wilt and gradually die in the same manner as when attacked by a root disease of fungoid origin. Examination of one of the roots reveals presence of a scale insect—as yet unidentified. It may be present in large numbers or on only one portion of a small lateral root. The scale insects are usually covered by a mass of sterile mycelium more or less closely woven together. This structure is brown externally, white in the mass, and may be so arranged as to form a series of shelters or chambers within which the insects are housed. In the later stages of the disease, the insects are not so numerous as at the beginning of the attack, and affected roots have the appearance of being covered with a brown crust. Masses of soil and small stones may cling

to the roots—an appearance apt to be confused with that due to *Hymenochaete*. The general colour of a diseased root mass is brown, with white patches where the mycelium is exposed, but, in some cases, black is the predominating colour. The roots lose all their tissues external to the wood, and become dry and brittle; the collar of the tree cracks irregularly and turns black.

It is not yet fully decided what parts in the working of the ruin of the trees are played by the insects and the fungus respectively. Investigations up to date have shown that the mycelium is non-parasitic, and there is, therefore, an inclination to put the blame upon the insect alone. Certainly the final condition of an infested root points to the results of the sucking of juices by such a pest as a scale insect.

The same scale insect has been found on lemon grass and banana roots. Its presence on the latter host may account for the infection of coffee planted in abandoned native gardens. As regards other coffee, i. e., coffee planted in new land, field investigations were made on areas both planted and in process of being opened up. The responsible scale insect was found in both cases; in the former, on decaying pieces of wood unearthed from various depths in those parts where the root-disease was prevalent, and, in the latter, on the roots of certain indigenous trees. Similarly, a white mycelium resembling that of affected roots, was common on decaying timber below ground.

It was thus established that the pest was in the original land, and there is no doubt that the disease can be traced in each case to such sources as those outlined above. It must be noted, however, that the insect found on the indigenous roots was always present in very small numbers, and was not invariably accompanied by the mycelium. The relative amount of mycelium on attacked roots is by no means constant. The variations may be accounted for by local circumstances, and by the presence or absence of ants, which have in all probability an influence on the distribution of both insect and fungus.

Preventive measures are obvious. They include the removal of stumps, roots, and debris, exposure of the soil, and treatment with lime or Fungal (carbon bisulphide), before planting. Several remedial experiments are in progress. It is as yet too early to look for results, but it may be mentioned that reports are encouraging. The substances employed were lime, Fungal and a 10% solution of kerosene emulsion. It is probable that the use of the last named insecticide will be attended with success if the disease be noticed in good time. Carbon bisulphide has been applied to affected roots with apparent success, and it is probable that in this substance will be found the only satisfactory remedy for attacked trees.

Cacao.

Green Fly. Several reports of this pest (*Toxoptera theobromae*, Schout.,) have been received. Against it, a whale-oil soap spray can be successfully employed.

Cacao Beetle. Reports of the presence of this beetle (*Adoretus hirtellus*, Castn.,) have not been numerous, but, in one or two cases, it has done considerable damage to nursery and young plants. Its depredations are easily recognised. The insect eats away portions of the leaf between the veins, and leaves a mere skeleton. The treatment recommended for leaf-eating caterpillars is suitable for this pest, or a lead arsenate spray (6 lbs. arsenate to 100 gallons of water) can be used successfully.

Cacao Fruit Fly. The Cacao fruit fly (*Ceratitis punctata*, Wied.,) has not caused much damage.

Scale Insects. *Stictococcus dimorphus*, Newst., and *Pseudococcus* sp. attack Cacao. An account of the former, written by the Entomologist, appeared in the Annals of Applied Biology, Vol. I. p.399. The following notes are taken from that publication.

The pest appeared in 1909. It affects as food plants Cacao, Mulberry, *Markhamia platycalyx*, Hibiscus, *Anona muricata*, *Croton tiglium*, Guava, and *Cajanus indicus*. Of these, Cacao is the favourite, and of Cacao varieties *forastero* is preferred to *criollo*. The parts attacked are always the pod and its stalk.

Seven different treatments have been experimented with, and the most successful were whale-oil soap and soft soap kerosene emulsion. The former is made up with 1 lb. soap to 4 gallons of water, and the latter of kerosene 2 gallons, soap $\frac{1}{2}$ lb., and hot water 1 gallon. This forms a stock solution, one gallon of which is diluted for use with two and one third gallons of water.

The noctuid moth, *Eublemma costimacula*, Saalm., has been found to be parasitic on *Stictococcus dimorphus*. Another species of the same genus, viz., *St. gowdeyi*, attacks coffee.

Crickets.

Gryllotalpa africana, P. de B.

Gryllus bimaculatus, de G.

Gryllus gracilipes, Sauss

These insects should be attacked according to the methods given under the account of the same pests on coffee.

Mosquito Blight. It is to be regretted that this pest (*Helopeltis* sp.) has made its appearance in Uganda. It is, at present, confined to one estate, but it will be found more widely distributed in the future. It was first observed in a plot situated near a patch of forest; every tree in the plot was attacked. The pods are most affected, their surfaces being broken and covered with masses of small, black, more or less circular raised patches of "Scabs." Pods only one inch in length are attacked. These blacken and die, while older pods shrink. Subsequently young twigs have been found to be affected, and the pest to have extended to other plots. Both adults and young can be seen feeding upon the pods.

Two methods of contact treatment were recommended, but neither of these has been tried up to date. One was a lime-sulphur preparation; the other was made up of whale-oil soap, carbolic acid, and Paris Green in water, lime or clay being added to make a paste to be applied to the pods. Numbers of the insects can be caught by means of a stick smeared with an adhesive substance.

Before an attack from all sides can be made on this *Helopeltis*, various points in connection with the history and habits of the insect must be cleared up—whether shade is conducive to its presence, whether it is to be found on indigenous trees and plants, where egg-laying takes place (the eggs have not yet been found in twigs or leaves), where hibernation takes place, whether soil, site, mulching, manuring, etc., have any influence on distribution.

Whether the pest will absent itself from the trees after the picking of the pods is not yet clear, nor can it be said whether or not *Helopeltis* will move from one group of trees to another as the pods ripen in succession. Meanwhile, the infested pods and branches which look as if they had been attacked, are being destroyed.

Rubber

A bee is sometimes found in the smaller branches of *Hevea* which have died back or have been killed. It is *Trigona clypeata*, Freise., and it adopts the above method of housing itself. It is unlikely to cause any damage to healthy wood.

Erythrina *Excelsa*

The larvae of an unidentified moth have been found to damage *Erythrina* trees by boring. Treatment consists of the injection of a few drops of carbon bisulphide as recommended for the Yellow-headed Coffee Borer.

Cotton

A small attack of grasshoppers (*Zonocerus variegatus*, Linn.) was reported from the Hoima district. The use of Paris Green applied in powder form was advised.

Spiny Bollworm, *Earias insulana*, Boisd.

Stainers, *Dysdercus nigrofasciatus*, Stal.

D. pretiosus, Dist.

Oxycaraenus hyalipennis, Costa.

O. gossipinus, Dist.

Leaf-footed Plant Bug, *Leptoglossus membranaceus*, Fab.

As regards the above pests, there is nothing to be added to the very full accounts of them given by the Entomologist in last year's report. During a tour in the Eastern Province, during which many Cotton plots were inspected, the writer came to the conclusion that these harmful insects were as numerous as in previous years.

Collecting

The systematic collecting of insects has been suspended since August the only insects received in the meantime being those collected by Medical Officers and others. In addition to the following list of insects donated to the Imperial Bureau of Entomology, collections of certain groups have been sent to specialists for identification

Orthoptera	...	159	Coccidae	...	15 species
Neuroptera	...	3	Aleurodidae	...	2 spp.
Hymenoptera	...	432	Other Hemiptera	777	
Coleoptera	...	1906	Thysanoptera	...	210
Lepidoptera	...	22	Myriapoda	...	5
Diptera	...	116	Ixodidae	...	numerous.

Imports of Plants, etc.

The following table shows the imports of plants, seeds, etc., into the Protectorate during the year. The numbers represent consignments. A consignment may consist of one or more large boxes or of a small packet.

W. SMALL,

Acting Entomologist

Consignments of	Countries of Origin.															
	United Kingdom	France	Italy	Holland	Germany, B. E. A.	Zanzibar	South Africa	West Africa	West Indies	Trinidad	Belgian Congo	Soma-land	Java	Fed. Malay States	India	Total
<i>Seeds :</i>																
Coffee	.	.	.	.	.	1	.	.	.	.	1	1	20	1	.	24
Tea	.	.	.	1	.	.	.	.	1	.	.	.	1	.	2	3
Tobacco	.	.	.	.	12	.	.	.	.	.	.	.	.	.	.	1
Fruit trees	16	5	.	1	.	1	.	.	.	.	.	.	.	1	.	37
Vegetables	3	1	.	1	.	.	1	.	.	.	.	.	.	.	3	6
Ornamental plants	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Cloves	.	.	.	.	.	.	.	.	.	1	.	.	.	.	3	4
Forest trees	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2
<i>Erythrina's</i>	.	.	.	.	1	.	.	.	.	1	.	.	.	.	.	1
Grass	.	.	.	.	.	.	.	.	2	1	.	.	12	.	.	16
Miscellaneous	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Mango	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
<i>Pods :</i>																
Cacao	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	1
<i>Trees :</i>																
Fruit	1	.	.	.	4	.	.	.	.	.	.	.	.	.	.	5
Citrus	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	2
<i>Roots :</i>																
Mint	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
Ornamental plants	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Pineapples	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
Total	21	7	1	3	1	2	1	1	3	2	1	1	33	2	9	109

APPENDICES.

Appendix 1.

Estimated Number of Live Stock In the Protectorate.

Province.	District.	Horses.	Mules.	Donkeys.	Cattle.	Sheep.	Goats.
Buganda	Mengo	1	5	20	57,000	16,000	171,000
	Entebbe	—	—	11	2,732	1,077	14,930
	Masaka	—	1	13	68,524	13,692	42,173
	Mubendi	—	1	1	8,200	4,365	23,620
Eastern	Busoga	—	4	10	40,000	15,000	40,000
	Bukedi	—	1	150	55,000	40,000	122,000
	Teso	—	—	20	132,853	38,746	93,413
	Lango	—	1	50	50,000	85,000	250,000
	Karamoja } Lobor }	No basis for estimate.					
Northern	Masindi	—	2	4	1,800	1,400	9,500
	Hoima	—	—	2	4,500	1,500	9,000
	Gulu	—	1	20	?	?	?
	Chua	—	—	—	?	?	?
	West Nile	—	3	1	50,000	40,000	80,000
Western	Toro	—	—	—	43,000	46,000	78,500
	Ankole	—	2	4	330,000	275,000	300,000
	Kigezi	—	2	—	?	?	?
Rudolf	Turkwel Turkana Dabossa }	No basis for estimate, but the number known to be very large.					

Appendix 2.

Native Agriculture

Province	District	Cotton	Ground Nuts	Sim Sim	Plantains	Sweet Potatoes.
		Acres	Acres	Acres	Acres	Acres
Buganda	Mengo	18,000	1,750	4,500	390,000	180,000
	Entebbe	3,802	250	940	29,600	11,650
	Masaka	5,496	1,190	1,400	120,000	15,250
	Mubendi	1,580	200	2,100	11,700	13,800
Eastern	Busoga	20,000	...	...	225,000	...
	Bukedi	25,000	...	...	...	...
	Teso	35,000	...	...	...	...
	Lango	7,600	...	...	...	...
	Karamoja	...	...	...	...	...
	Labor	..	...	...	...	...
Northern	Masindi	1,200	...	2,000	4,000	30,000
	Hoima	400	100	600	1,500	3,000
	Gulu	530	...	...	...	...
	Chua	...	...	...	...	...
	West Nile	20	800	11,000	..	1,200
Western	Toro	100	800	1,000	12,000	10,000
	Ankole	50	500	100	25,000	20,000
	Kigezi	..	...	...	2,500	5,500
Rudolf	Turkwel	No basis for an estimate.				
	Turkana					
	Dabossa					

NATIVE AGRICULTURE--Contd.

Province	District	Coffee	Rubber	Wheat	Millet	Miscellaneous.	Total number of acres in crop	Total area of District
		Acres	Acres	Acres	Acres	Acres		
Buganda	Mengo	3,000	2,000	10	300	Maize Beans Rice Peas Chillies	600,000	6,194,560
	Entebbe	1,167	1,183	...	250		52,000	535,040
	Masaka	3,850	30	14	1,140		141,374	2,374,400
	Mubendi	250	70	2	6,000		48,000	1,536,000
Eastern	Busoga	5	50	...	...	Rice	410,000	2,190,080
	Bukedi	60	7	...	...		223,525	2,245,120
	Teso	...	...	...	85,000		265,000	2,450,000
	Lango	...	...	...	120,000		350,000	3,254,400
Northern	Karamoja	No basis for an estimate.						3,571,800
	Lobor							3,435,520
	Masindi	...	...	...	...		150,000	2,988,940
	Hoima	300	...	...	3,300		11,100	1,728,000
	Gulu	...	...	...	...		...	3,920,400
	Chua	...	...	...	...		...	5,461,400
Western	West Nile	...	...	...	70,000		92,470	2,916,000
	Toro	50	...	500	30,000	Peas Maize Cassava Beans	72,160	3,407,600
	Ankole	10	5	10	3,000		80,000	3,834,000
	Kigezi	...	...	2	40,000		160,000	1,195,200
Rudolf	Turkwel	No basis for an estimate						943,200
	Turkana							4,107,600

Appendix 3.

EUROPEAN CULTIVATION

Returns from 101 plantations have been received. The area of land taken up for plantations is approximately 58,000 acres, of which some 22,000 are under cultivation.

Province	District	Number of Estates	Total area under cultivation in acres	Acreage of Coffee Arabica only		Acreage of Coffee Robusta only		Acreage of Para		Acreage of Cacao	
				under 2 yrs.	over 2 yrs.	under 2 yrs.	over 2 yrs.	under 5 yrs.	over 5 yrs.	under 5 yrs.	over 5 yrs.
Buganda	Mengo	69	13,512	1,339	3,193	29	278	1,190	108	1,269	16
	Entebbe	12	1,854	155	401	8	15	190	—	262	—
	Masaka	15	1,544	574	621	—	—	114	—	74	—
	Mubendi	8	865	450	304	13	—	—	4	28	—
Eastern	Busoga	10	2,220	470	1,060	1	—	32	—	181	—
Northern	Bunyoro	11	940	322	80	20	—	—	—	38	—
Western	Toro	10	740	515	67	3	—	—	—	—	—

EUROPEAN CULTIVATION (Contd.)

Province	District	Acreage of Coffee and Para		Acreage ready for Cacao	Acreage of Ceara.
		under 2 yrs.	2 yrs and over		
Buganda	Mengo	945	2,985	470	645
	Entebbe	38	583	440	—
	Masaka	31	53	155	—
	Mubendi	—	—	68	2
Eastern	Busoga	—	100	220	25
Northern	Bunyoro	100	—	74	—
Western	Toro	—	—	—	—

MISSION AGRICULTURE.

Province	Coffee	Para	Cacao	Ceara	Cotton.
Buganda	550	166	60	230	500
Eastern	25	—	13	2	85
Western	10	—	—	—	—
Northern	80	—	24	50	—

Appendix 4.

COTTON GINNERIES

Twenty Power Ginneries are now at work :—

Eastern Province	11
Buganda Province	8
Northern Province	1

Particulars of Machinery	Total
Power Roller Gins	180
" Saw "	33
" Baling Presses	18
Seed Openers	16
Delinters	3
<i>Kind of Power :—</i>	
Steam	3
Oil	9
Suction Gas	8
Hand Gins	70

Very few of the Hand Gins are in use.

Imperial Institute Report on Five Samples of Unginned Cotton Grown on the Kadunguru Plantation, Bugondo,
and Forwarded 7th February, 1914.

Variety.	Lint.	Strength.	Length.	Commercial Valuation with June futures. Middling American at 7.42d.	Remarks.
No. 1. Allen ordinary.	Clean, very soft, lustrous, of pale cream colour with a very few small brownish or yellowish stains.	Irregular, on the whole poor. A large proportion of weak immature fibre present.	From 1.0 to 1.6 inch ; mostly from 1.2 to 1.4 inch.	8.60d.	This cotton was of very good appearance, but lacking in strength.
No. 2. Allen's Plot No. 4.	Clean, very soft, lustrous, of pale cream colour with occasional small yellowish or brownish stains.	Irregular, on the whole fair. A small proportion of weak immature fibre present.	From 1.3 to 2.0 inch ; mostly from 1.4 to 1.6 inch.	9.40d.	This cotton was of excellent appearance, and of much better strength than the preceding sample No. 1.
No. 3. Allen's Plot No. 17.	Clean, very soft, lustrous, of pale cream colour with occasional small yellowish or brownish stains.	Fairly good.	From 1.2 to 1.7 inch ; mostly from 1.3 to 1.5 inch.	8.80d.	This cotton was of good appearance, and intermediate in length between samples 1 and 2.
No. 4. Sunflower.	Clean, very soft, lustrous, pale cream colour, and free from stains.	Fairly good.	Irregular, from 1.1 to 1.7 inch ; mostly from 1.4 to 1.6 inch.	8.60d.	This cotton was of very good colour, but of rather irregular strength.
No 5. Sunflower.	Clean, very soft, lustrous, of pale cream colour, and free from stains.	Fair.	From 1.0 to 1.6 inch ; mostly from 1.3 to 1.5 inch.	8.70d.	This cotton was valued slightly higher than sample No. 4 owing to its more regular length.

GENERAL REMARKS.

These five Cottons from Uganda are of a very promising quality. Their chief defect is a little irregularity in length and strength, but it seems evident, on comparing samples 1 and 2, that continued selection will probably lead to the production of a strong, uniform staple. 27th June, 1914.

Appendix No. 6.

Imperial Institute of the United Kingdom, the Colonies,
and India.

REPORT ON TEA FROM UGANDA.

Description of Samples.

- (1) "
- Golden Tip*
- ". Weight
- $5\frac{1}{2}$
- ozs.

Dried, rolled tea, clean and in good condition, and varying from pale brown to black in colour, a large proportion of the paler leaf being present.

- (2) "
- Broken Leaf*
- ". Weight
- $7\frac{1}{2}$
- ozs.

Dried, rolled, black tea, mostly composed of broken leaf, and containing a small proportion of powder.

Results of Examination

The teas, as received, were examined with the following results, compared with the previous sample from Uganda :—

	No. 1. Golden Tip. per cent.	No. 2. Broken Leaf. per cent.	Previous Sample. per cent.
Moisture.	8.8	8.8	8.05
Caffeine.	4.90	3.85	3.67
* Tannin.	12.6	15.5	9.5
Ash.	4.2	4.8	4.76
† Extract.	35.2	35.0	36.0

* Determined by Procter's modification of Lowenthal's process.

† The percentage dissolved by treating a given quantity of tea with 100 times its weight of boiling water and allowing it to infuse for 10 minutes.

From the foregoing results it is seen that sample No. 1 contained a high percentage of caffeine, the average amount for Indian or Ceylon teas being about 3.5 to 4.0 per cent. In other respects the tea is of normal composition, though the percentage of tannin is rather higher than usual.

The analysis of sample No. 2 shews it to be of normal composition and to resemble closely the previous sample of Uganda tea, except as regards the percentage of tannin. The amount of this constituent appears to have been considerably increased by a longer fermentation to which the leaf had been subjected as compared with previous sample.

Commercial Valuation

The samples were submitted to a firm of brokers, who valued No 1 at about 1s.4d., and No. 2 at about 8d. per lb. in London (August, 1914). They added that the "Golden Tip" leaf, No. 1, was somewhat a fancy article, which they considered could only be produced in small quantities.

The firm stated that the longer fermentation to which these teas had been subjected as compared with the earlier sample from Uganda had resulted in some improvement in the colour of the liquor; but there is still a lack of strength in comparison with India and Ceylon teas. They suggested that this defect might be remedied by harder rolling

5th September, 1914.

COMPARATIVE STATEMENT OF EXPORTS CONNECTED WITH AGRICULTURE

Articles	Unit	Year ended 31-3-11		Year ended 31-3-12		Year ended 31-3-13		Year ended 31-3-14		Year ended 31-3-15	
		Quantity	£	Quantity	£	Quantity	£	Quantity	£	Quantity	£
Coffee Husked.	cwts	270	383	1,712	2,563	3,336	8,940	12,252	23,167	2,103	5,542
Coffee In parchment }	"	17,462	20,492	13,643	16,658	10,599	12,408	7,205	8,247	18,998	35,463
Chillies	"	7,056	3,180	9,155	4,279	11,780	5,570	7,671	3,740	5,116	5,835
Groundnuts	"	3,029	6,109	2,911	5,819	4,737	11,439	4,851	12,507	156	76
Ghee (clarified butter)	"	330	263	289	226	319	301	216	193	4,693	12,264
Jaggree (unrefined sugar)	"	10,589	4,477	13,855	7,048	31,402	16,812	17,919	10,449	265	159
Simsim seed	"	32,694	120,664	59,277	184,639	77,728	214,170	85,217	272,366	8,514	4,764
Cotton ginned	"	50,281	44,748	45,664	46,211	48,538	40,209	44,130	45,321	107,139	320,486
" unginned	"	32,078	3,208	58,549	5,909	112,283	11,335	134,128	13,499	30,188	33,660
Cotton seed	"	3,950	162	3,539	162	2,352	117	882	42	180,334	18,172
Beeswax	lbs	7,551	20,544	9,032	26,191	12,878	45,854	13,837	52,926	350	17
Hides	cwts	898	13,412	277	4,117	243	3,647	93	1,107	38,138	54,917
Rubber	lbs	552	147	2,102	325	4,474	834	19,454	2,934	..	..
" plantation	no.	664,430	24,920	581,615	22,249	573,852	28,543	464,987	29,037	22,056	1,838
Skins (goats)	"	95,160	1,771	77,964	1,569	83,989	1,940	59,644	1,615	364,384	19,091
" (sheep)	"	460	1,277	225	705	847	2,941	1,052	4,204	22,178	506
" (calf)	cwts	..	1,278	..	4,979	..	7,994	..	582	732	2,710
Miscellaneous	no.	..	..	..	..	..	..	..	..	..	558
Cotton seed cake	cwts	13,088	1,322	3,213	3,776	583	716	..	..	..	..
" oil	galls	3,263	355	..	..	7	12	..	..	21	25
Simsim oil	"	..	..	3	75	..	..	..	..	3	6
Horses	no.	..	..	8	207	..	..	..	..	..	..
Mules	"	2	66	..	601	..	..	..	..	..	..
Donkeys	"	103	126	450	1,144	2	4	..	..	..	..
Cattle	"	..	..	382	1,144	1,516	6,205	246	1,006	13	17
Miscellaneous live stock	"	889	556	710	474	632	428	..	..	266	789
Miscellaneous	"	..	1,584	..	1,954	..	3,333	..	3,792	..	..
GRAND TOTAL			£271,044		£341,870		£423,752		£486,223		£516,907

REPORT OF THE COMMISSIONER OF THE LAND OFFICE

1890

Section	Range	Township	County	State	Acres	Owner	Remarks
1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9
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100	100	100	100	100	100	100	100